THE EFFECT OF PULSE SEPARATION ON SUBJECT RESPONSE USING A DYNAMIC PRELOAD DEVICE

Joseph P. Strzelecki

BIODYNAMICS & BIOENGINEERING DIVISION

JULY 1990

INTERIM REPORT FOR PERIOD 16 MARCH 1990 TO 16 JULY 1990

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HARRY G. ARMSTRONG AEROSPACE MEDICAL RESEARCH LABORATORY
HUMAN SYSTEMS DIVISION
AIR FORCE SYSTEMS COMMAND
WRIGHT-PATTERSON AIR FORCE BASE, OHIO 45433-6573

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FOR THE COMMANDER

James W. Brinkley

JAMES W. BRINKLEY
Director, Biodynamics and Bioengineering Division
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REPORT DOCUMENTATION PAGE	*Form Approved OMB No 0704-0188*

1. AGENCY USE ONLY *(Leave blank)*	**2. REPORT DATE** July 1990	**3. REPORT TYPE AND DATES COVERED** Interim - 16 March 90 to 16 Jul 90

4. TITLE AND SUBTITLE
(U) The Effect of Pulse Separation on Subject Response Using a Dynamic Preload Device

5. FUNDING NUMBERS
PE - 62202F
PR - 7231
TA - 723131
WU - 72313101

6. AUTHOR(S)
Joseph P. Strzelecki

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Crew Protection Branch
Biodynamics and Bioengineering Division
Harry G. Armstrong Aerospace Medical Research Laboratory
Wright-Patterson AFB OH 45433

8. PERFORMING ORGANIZATION REPORT NUMBER
AAMRL-TR-90-075

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT	**12b. DISTRIBUTION CODE**
Approved for public release; distribution is unlimited	A

13. ABSTRACT *(Maximum 200 words)*
Twenty-eight fully instrumented tests were conducted using the Harry G. Armstrong Aerospace Medical Research Laboratory Vertical Deceleration Tower modified to incorporate a dynamic preload device designed by Survival Engineering Corporation of Asheville NC. Analysis of the data and computer simulations showed that use of dynamic preload could provide an ejection seat with a much greater escape displacement in a given time interval than would be the case if no dynamic preload were used for the same allowable value of the Dynamic Response Index. The tests were conducted using the large Advanced Dynamic Anthropomorphic Manikin (ADAM) as a test subject.

14. SUBJECT TERMS
Dynamic Preload
Dynamic Response Index
Impact Tests

15. NUMBER OF PAGES 172

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	**18. SECURITY CLASSIFICATION OF THIS PAGE**	**19. SECURITY CLASSIFICATION OF ABSTRACT**	**20. LIMITATION OF ABSTRACT**
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UL

NSN 7540-01-280-5500

Standard Form 298 (Rev 2-89)
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298-102

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PREFACE

The tests described in this report were accomplished by the Biomechanical Protection Branch, Biodynamics and Bioengineering Division of the Harry G. Armstrong Aerospace Medical Research Laboratory. The tests were conducted under Workunit 72313101.

The impact facilities, data acquisition equipment, and data processing system were operated by the Scientific Services Division of DynCorp under Air Force Contract F33615-86-C-0531. Mr Marshall Miller was the Engineering Supervisor for DynCorp. Mr Steve Mosher of DynCorp did the computer programming required for the data analysis.

Photographic data and documentation services were provided by the Technical Photographic Division of the 4950th Test Wing.

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INTRODUCTION

1.1 BACKGROUND

The maximum safety factor in the operation of a manned escape system is achieved when the system is ejected from the cockpit as rapidly as possible in order to clear the empennage of the aircraft. However, physiological limitations associated with spinal loads on the occupant dictate an upper bound on the acceleration levels of the escape system. The optimum acceleration-time history of the escape system is that time history which leads to maximum escape velocity and escape distance achievable within the acceleration limits allowable on the occupant (Payne and Shaffer, 1974).

Minus X-axis impact tests conducted using a coasting sled impacting a decelerator first demonstrated that preimpact conditions have a significant influence on a subject's responses and tolerance to the subsequent impact, as the coasting sled is generally decelerating at a rate of at least 0.3 G (Hearon et al, 1982; Brinkley and Raddin, 1985).

Phillips (1972) demonstrated analytically that for Z-axis impact, a helicopter seat equipped with an energy absorber with a "notched" force-displacement curve could significantly reduce the probability of injury in a crash.

Payne and Shaffer showed analytically that an impulsive acceleration applied prior to a ramped main acceleration could provide an increase in velocity change with no increase in the probability of injury. This was accomplished using a mathematical model, the Dynamic Response Index (DRI) model (Stech and Payne, 1965; Brinkley and Shaffer, 1971), to estimate the probability of compression fracture in the lower spine. The DRI model is a lumped-parameter single-degree-of-freedom analogy that uses the seat acceleration-time history as a forcing function. The maximum deflection of this model is then related to the probability of injury, which has been correlated with US Air Force operational ejection spinal injuries.

This study attempted to verify experimentally the benefits predicted by earlier work to accrue from using a dynamic preload. If the benefits proved significant, a follow-on study with human subjects would be performed.

The Advanced Dynamic Anthropomorphic Manikin (ADAM) used in this program was designed for the United States Air Force for use in high-performance aircraft escape system testing. The ADAM is based on Air Force male flight crew anthropometry with proper inertial, joint articulation, and motion-resistive properties. ADAM's spinal elements are designed to have elastic and viscous properties such that its seated dynamic responses are similar to those of a seated human.

1.2 OBJECTIVES

This test program had four main objectives:

1. To measure the dynamic response of the ADAM manikin during +Z axis impact for various time delays between the preload impulse and main plunger deceleration on the AAMRL Vertical Deceleration Tower (VDT).

2. To demonstrate the structural integrity of the preload device.

3. To demonstrate the functional capability of the preload device. Functional capability includes operating range, reliability, reproducibility, and other factors.

4. To identify test parameters for a possible follow-on experiment that would use human subjects.

SECTION 2
TEST METHODS

2.1 FACILITIES AND PROCEDURES

The tests were conducted using the Vertical Deceleration Tower (VDT). This device consists of a carriage constrained to vertical motion between two guide rails by means of guide wheels on the carriage. Attached to the carriage is a metal plunger aligned with a water cylinder attached to the floor.

To conduct a test, the carriage is hoisted to a predetermined height and released. The carriage falls, guided by the rollers and rails, until the plunger strikes the open face of the water cylinder. Compression and displacement of the water in the cylinder decelerate the carriage. In this program plunger 102 was used. This plunger generates a deceleration pulse with an approximately half-sine waveform.

Attached to the front face of the carriage was a generic seat with headrest. The seat geometry conformed to MIL-S-9479B (USAF) except that the included angle between the seat surface and the backrest was 90 degrees. The seat back angle was zero degrees (vertical) with respect to the acceleration axis. The seat was instrumented to provide accelerations and seat pan loads.

The restraint harness used consisted of a pair of shoulder straps tying into a generic lap belt at the belt buckle. The ends of the harness system were attached to triaxial load cells which served as anchor points. For each test, after the test subject was strapped in, the harness system was preloaded to 20 ± 5 lb as measured at each of the load cells.

The test subject was a large (approximately 95th percentile) prototype ADAM manikin weighing 218 lb and instrumented to provide head accelerations, chest accelerations, lumbar loads, and neck loads. The manikin was dressed in modified long underwear and an HGU-26/P flight helmet.

The preload deceleration pulse was provided by a device designed by Survival Engineering Corporation of Asheville, North Carolina (SEC, 1987). Attached to each side of the carriage is a blade with a vertical adjustment capability of ± 2 inches. Attached to the rail on each side of the carriage is a magazine containing a shear sample holder and a shear sample. For this test program the shear samples were made from 7075-T6 aluminum blocks 6.8 inches long. The block cross section was 1.50 inches by 0.75 inches. A 0.75 inch wide channel was milled out of the length of the block leaving a web thickness of 0.285 inches. Figure 1 shows a shear sample and shear sample holder. Attached to the bottom of the shear sample holder in the figure are shims which allow an adjustment of the vertical position of the shear sample of up to 1.75 inches.

Figure 2 shows the complete test setup. The blades on the carriage are just entering the tops of the sample holders, which serve to guide the blades, prior to shearing the sample.

FIGURE 1: SHEAR SAMPLE (LEFT) AND SAMPLE HOLDER WITH SAMPLE (RIGHT)

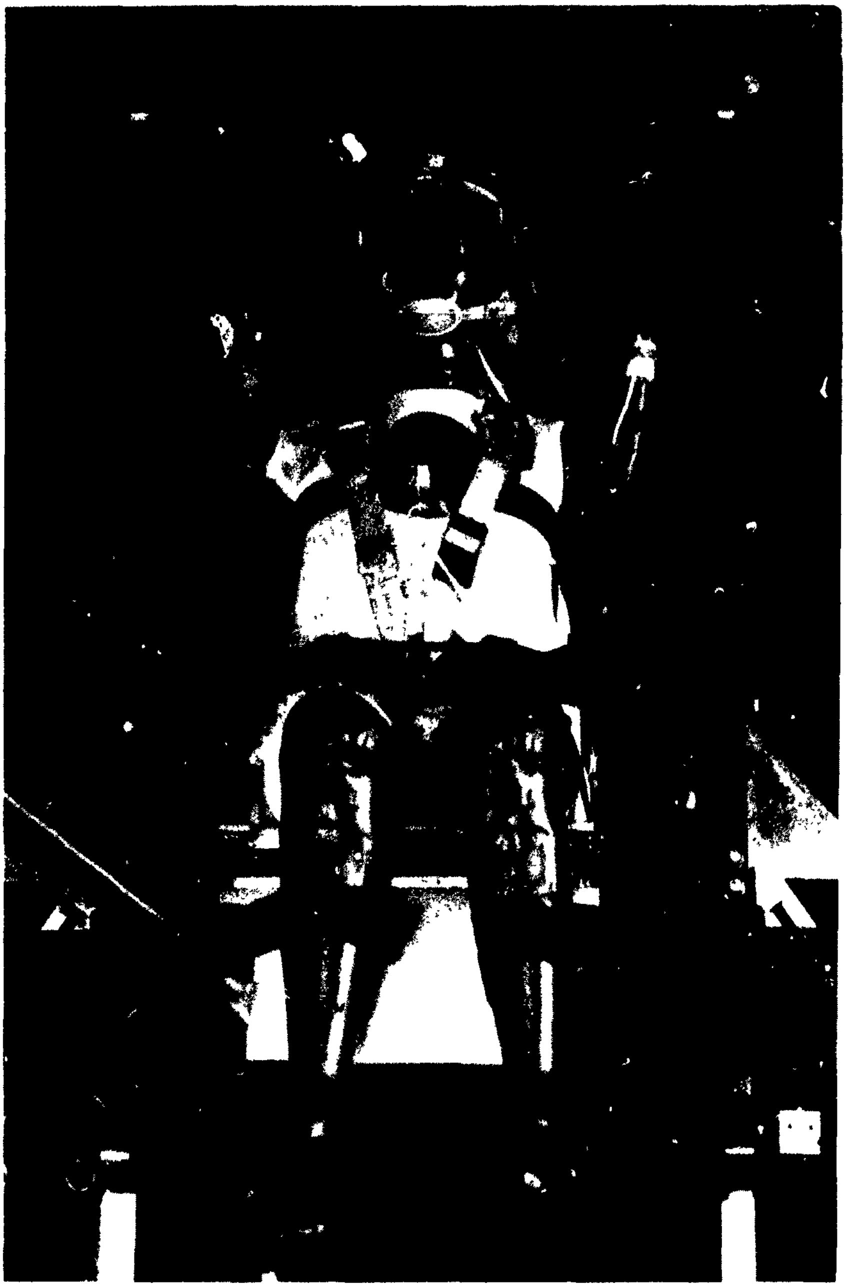


FIGURE 2. TEST SETUP

Table 1 shows the test matrix for this experimental program. Note that a blade position of "high" on the carriage means that the plunger will hit the water cylinder sooner after the preload pulse, while the "low" blade position will give the greatest separation between preload and plunger deceleration pulses.

TABLE 1. TEST MATRIX

CELL	BLADE POSITION	SAMPLE HOLDER SHIM HEIGHT (IN)
B1	N/A	N/A
C1	LOW	1.75
D1	LOW	1.25
E1	LOW	0.75
F1	LOW	0.25
G1	MID	1.75
H1	MID	1.25
I1	MID	0.75
J1	MID	0.25
K1	HIGH	1.75
L1	HIGH	1.25
M1	HIGH	0.75
N1	HIGH	0.25

Measurements taken during the impact tests included carriage and seat acceleration, seat and restraint anchor forces, manikin head and chest accelerations and displacements, and manikin neck and lumbar forces.

An attempt was made to keep the main plunger deceleration (as measured by the Z axis carriage accelerometer) constant at 7.0 G. The corresponding preload pulse (also measured by the Z axis carriage accelerometer) was also about 7 G for the test conditions used. There was some variability in the G level attained due to defects in the shear samples, variations in their heat treatment, and other unknown factors. Initial attempts to use an 8 G plunger deceleration pulse met with even greater variability.

2.2 ELECTRONIC DATA ACQUISITION SYSTEM

Both data acquisition and processing requirements were satisfied using the system described in Appendix A. Electronic equipment mounted on the test sled was used to amplify, filter, and encode the data from all data channels into a digital format (pulse code modulated), which was then transmitted via an umbilical cable to a word formatter. The word formatter reformatted the serial data into parallel data, which were then routed to a VAX computer for storage and analysis.

2.3 PHOTOGRAMMETRIC SYSTEM

Two 16 mm motion picture cameras were mounted on the carriage to record the movement of the test manikin. One camera provided a side view of the seated manikin and the other camera provided a front oblique view. Each camera operated at 500 frames per second and was synchronized with the electronic data by a pulse code and an electronic flash.

A video camera was also used to document the tests. This camera and the recorder used with it are capable of recording motion at a rate of 120 frames per second with an effective shutter speed of 10 microseconds or less. Use of this system allowed the investigators to evaluate the response to impact immediately after each test. This system is described in Appendix A.

2.4 DATA PROCESSING

Data from each test were reduced in a standardized format. Reduced electronic data are available for review within Appendix B. Computer summaries provide relevant maxima and minima from all recorded signals. Relevant sums and times were also computed. The sums of the measured forces are the maximum value of continuously summed measurements. Scaled plots of selected signals and computed resultants were also provided.

SECTION 3
RESULTS

3.1 QUALITY OF THE DATA

The accelerometers used to measure carriage and seat accelerations have filters with a cut-off frequency of 120 Hz. Examination of the "Carriage Z" and "Seat Z" accelerations in the data attached as Appendix B shows that lower-frequency harmonics are present in the seat Z data. This was confirmed by Fourier analysis. Because the DRI model response is greatly attenuated to frequencies over about 30 Hz, the seat Z acceleration data (which serves as input to the DRI model) was filtered with a cutoff frequency of 30 Hz. This makes the data much more intelligible.

One must ask if this filtering is removing more than just "noise" caused by the seat vibrating as a cantilever beam and other reasons. The seat is very massive and firmly attached to the carriage. One would not expect much difference between the carriage Z and seat Z accelerations.

Figure 3 shows the seat Z acceleration filtered at 30 Hz superimposed on the carriage data for test 1809 (cell B), which did not have a preload pulse.

Figure 4 provides a comparison when both the carriage data and seat data are filtered at 30 Hz.

Figure 5 compares carriage data filtered at 120 Hz and 30 Hz. The filtering has no appreciable effect on the data other than to smooth the curve.

Figures 3 and 4 indicate that the seat Z peak acceleration is slightly higher than that of the carriage, but that is not surprising since bolt hole tolerances and other factors would cause the seat to be neither perfectly rigid itself or completely rigidly mounted to the carriage.

Figures 6, 7, and 8 repeat this exercise for test 1796 (cell F). The calculated DRI for an input of seat-Z acceleration filtered at 120 Hz is 8.86. The calculated DRI for an input of seat-Z acceleration filtered at 30 Hz is 8.86. The difference is nil. As a final verification that the filtering does not affect the data other than to remove the higher harmonics, the seat Z acceleration for both the filtered and unfiltered cases were integrated and superimposed. Figure 9 shows that the differences are negligible.

All future references to seat Z acceleration in this report will refer to the data filtered with a cutoff frequency of 30 Hz, since the "as recorded" data are misleading when one refers to peak G levels in a discussion of manikin dynamic response.

3.2 SUMMARY OF TESTS

Table 2 lists all the tests conducted during this program for which data are available in Appendix 2. Those tests designated with an asterisk were selected for further analysis as they show the greatest consistency in pulse amplitude.

TABLE 2. SUMMARY OF TESTS

TEST NO.	CELL	CARRIAGE Z PRELOAD (G)	CARRIAGE Z MAIN PULSE (G)	DRI	ANALYSIS TESTS
1782	N1	3.77	9.60	11.57	
1783	M1	3.52	9.47	11.62	
1784	L1	<5.00	9.32	11.67	
1785	C1	<5.00	9.09	11.75	
1786	C1	7.08	7.20	9.54	
1787	C1	7.19	8.15	10.49	
1788	D1	7.20	7.44	9.60	
1789	D1	<5.00	8.96	11.31	
1790	C1	7.14	7.20	9.53	*
1791	D1	7.08	7.32	9.55	*
1792	E1	5.19	7.90	9.78	
1793	E1	5.11	7.94	9.91	
1794	E1	5.98	7.42	9.37	
1795	E1	5.75	7.02	9.07	*
1796	F1	6.36	6.84	8.86	*
1797	G1	6.72	7.08	8.93	*
1798	H1	6.35	7.13	8.68	*
1799	I1	6.71	7.32	8.72	*
1800	J1	6.82	7.12	8.51	*
1801	K1	6.77	7.14	8.33	*
1802	L1	6.07	7.28	8.14	
1803	M1	7.08	6.98	7.84	*
1804	N1	6.53	7.20	7.82	*
1805	L1	7.02	7.02	7.95	*
1806	E1	5.62	7.36	9.22	
1807	E1	7.68	6.59	8.75	
1808	B1	—	5.93	7.32	
1809	B1	—	6.99	8.86	*
1810	B1	--	7.98	10.44	

FIGURE 3
TEST 1809 CARRIAGE AND SEAT Z ACCELERATIONS

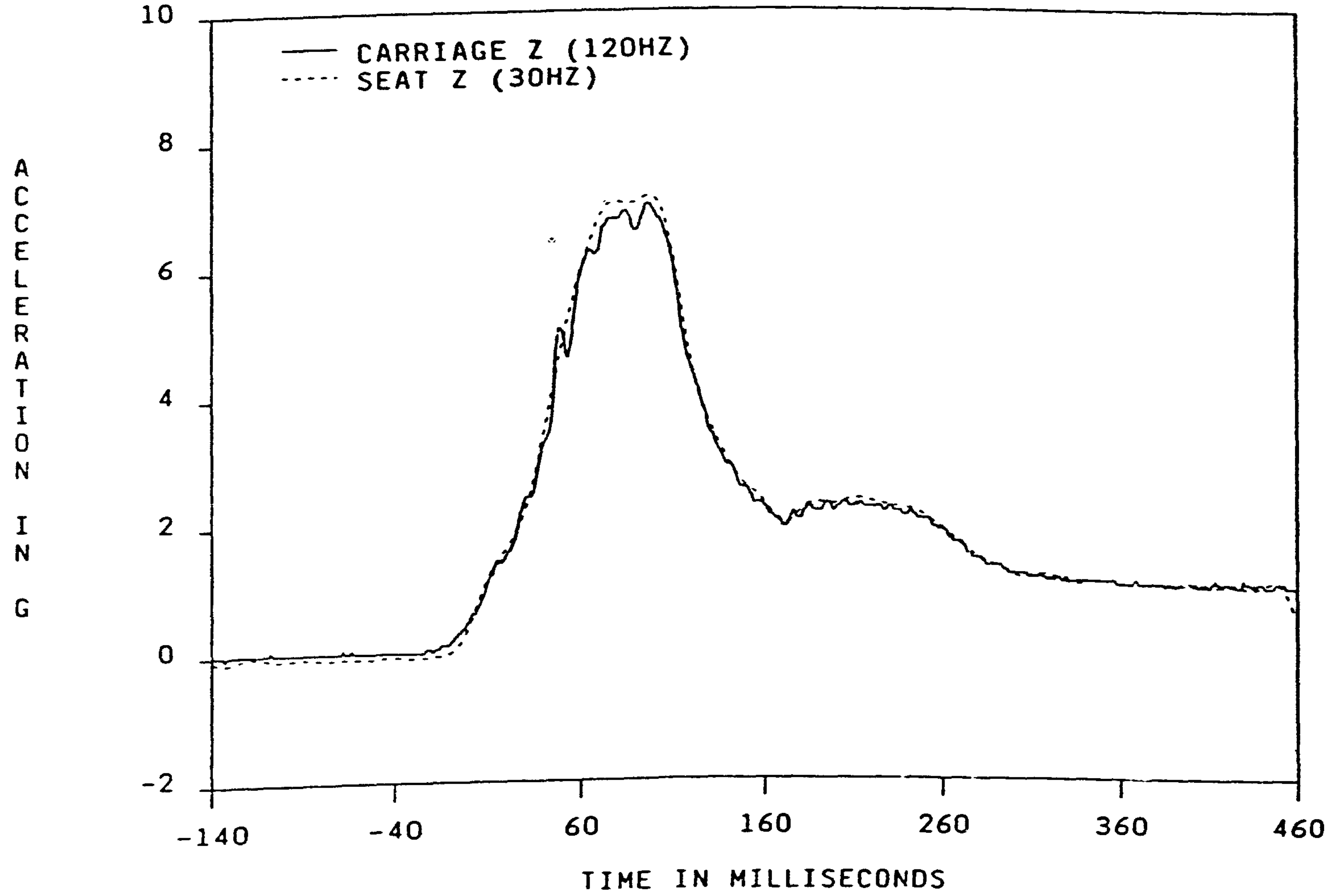


FIGURE 4

TEST 1809 CARRIAGE AND SEAT Z ACCELERATIONS

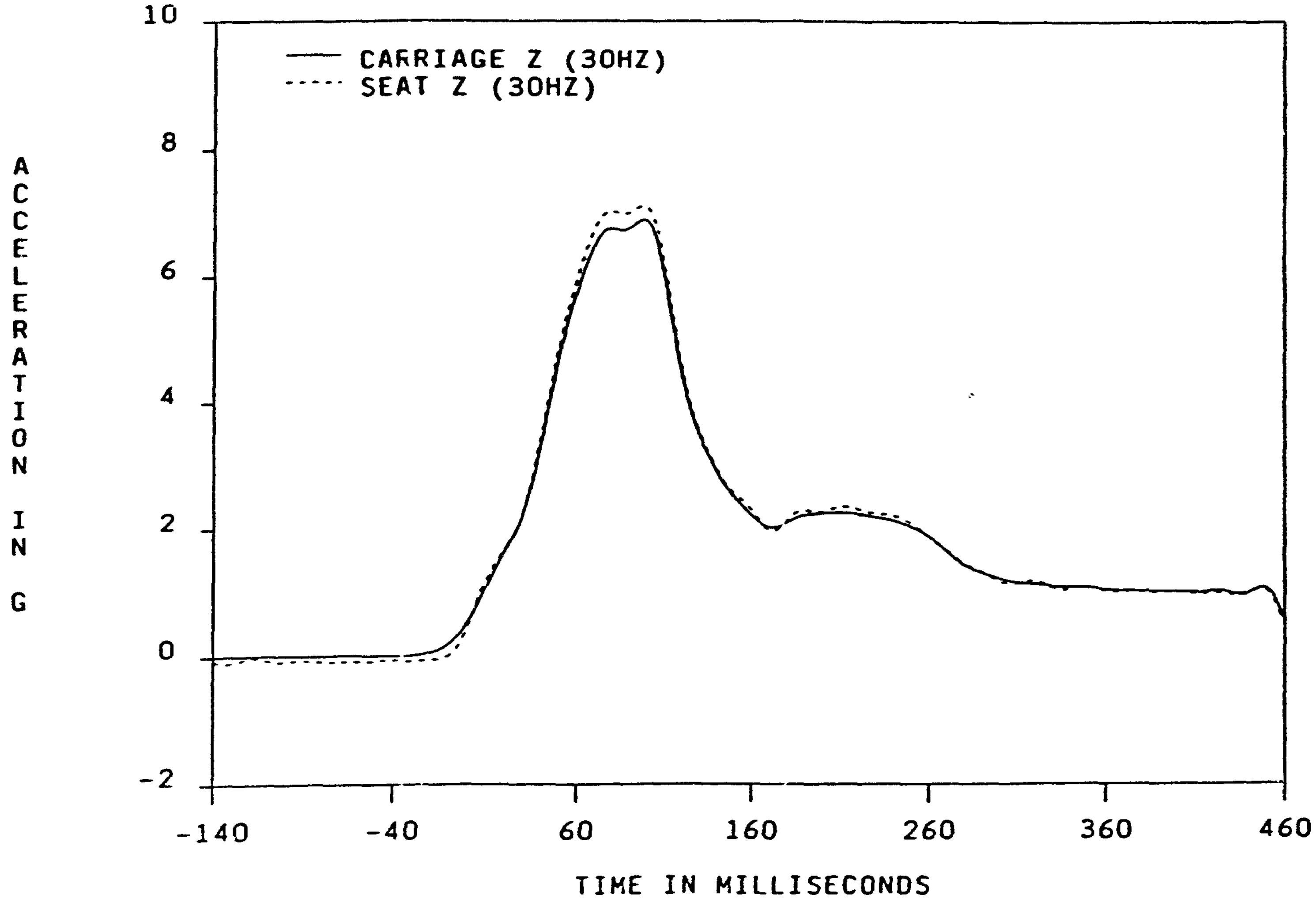


FIGURE 5

TEST 1809 CARRIAGE AND SEAT Z ACCELERATIONS

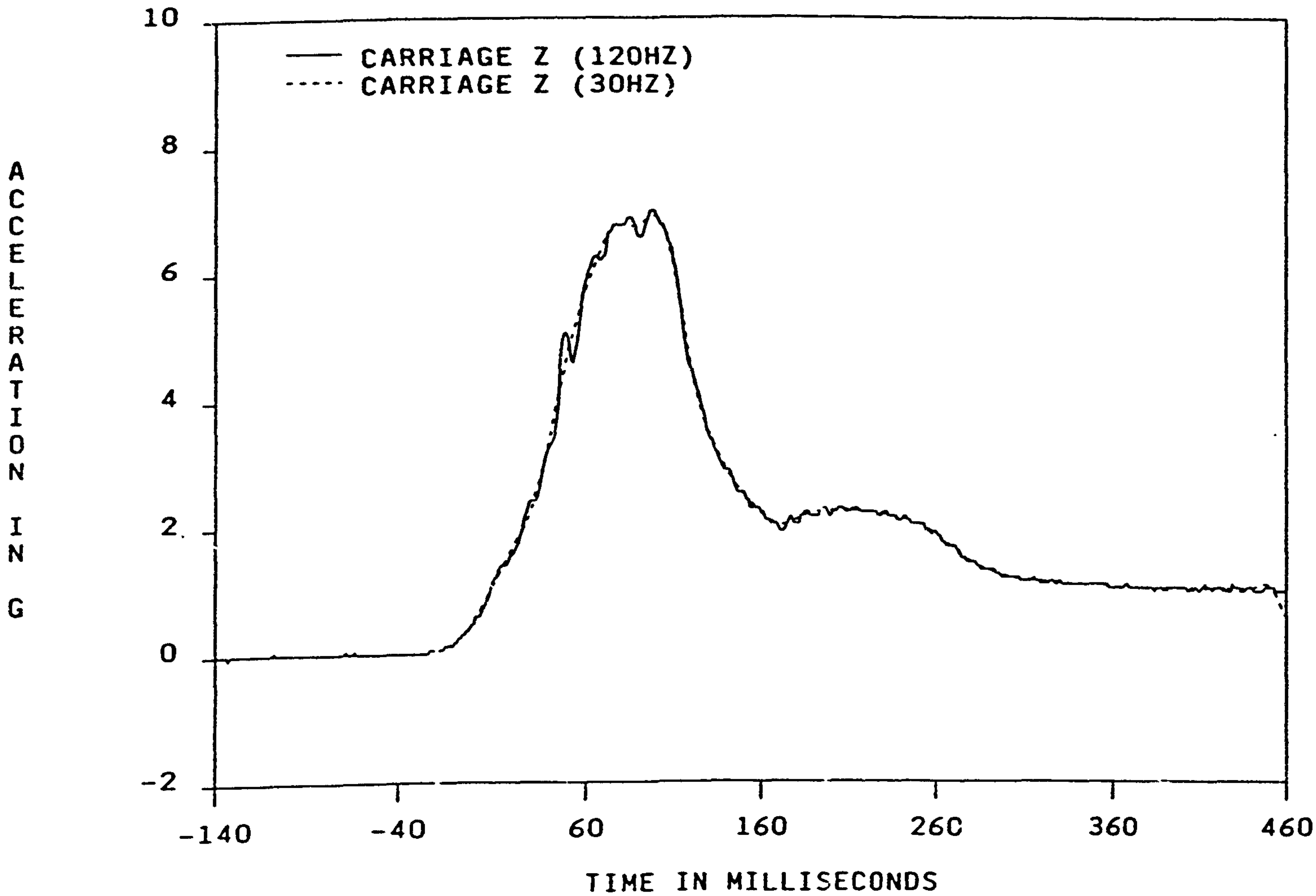


FIGURE 6

TEST 1796 CARRIAGE AND SEAT Z ACCELERATIONS

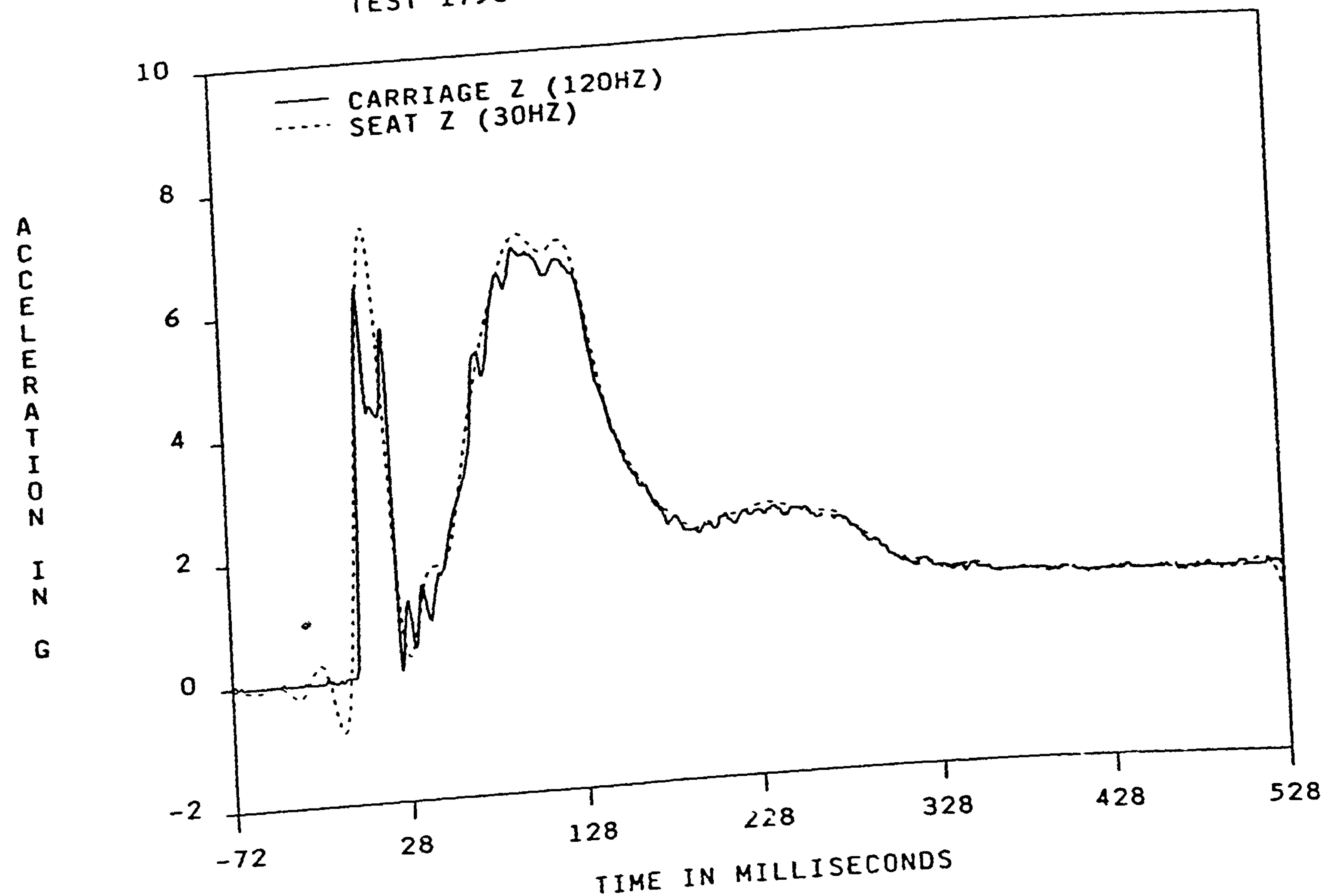


FIGURE 7

TEST 1796 CARRIAGE AND SEAT Z ACCELERATIONS

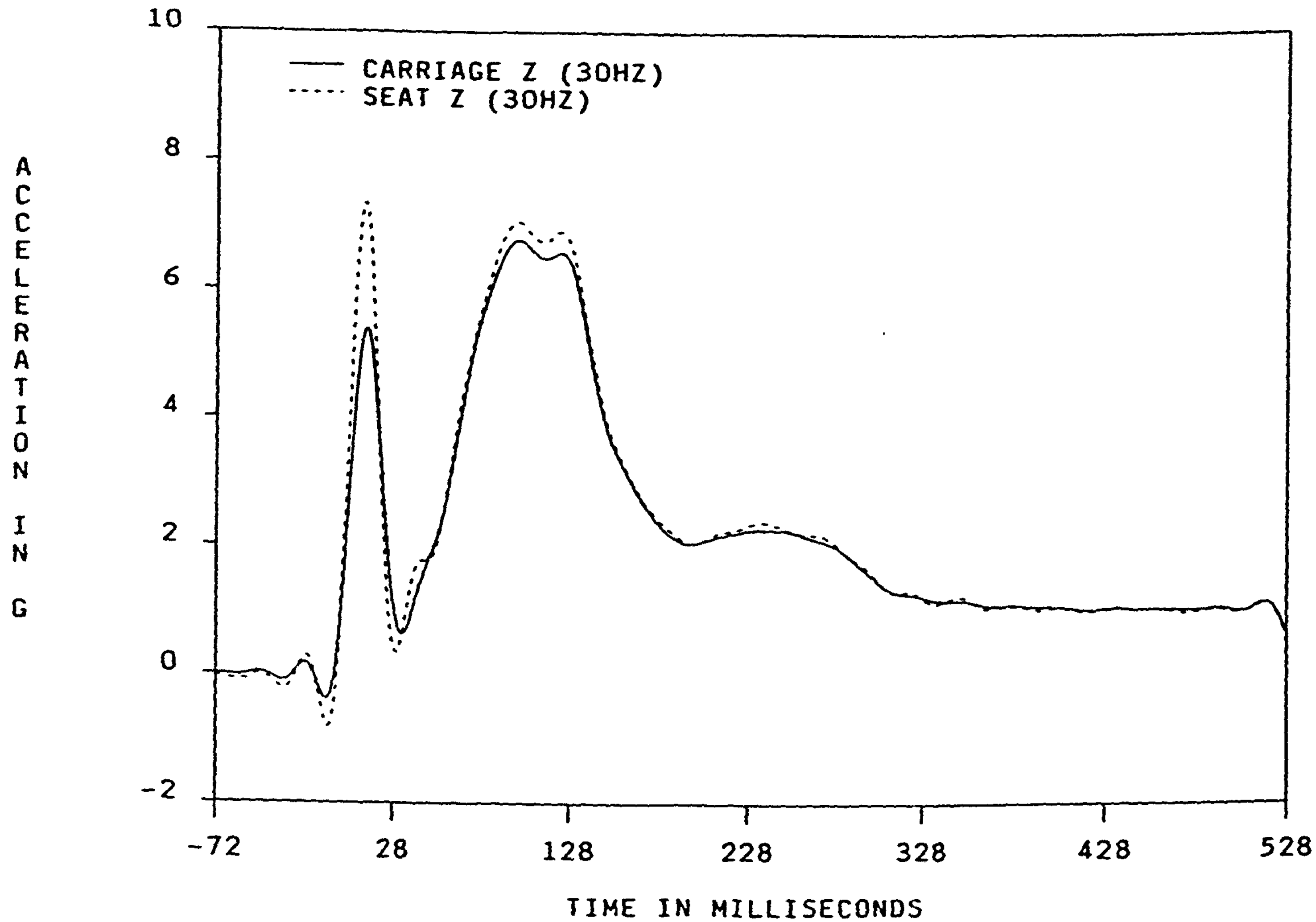


FIGURE 8

TEST 1796 CARRIAGE AND SEAT Z ACCELERATIONS

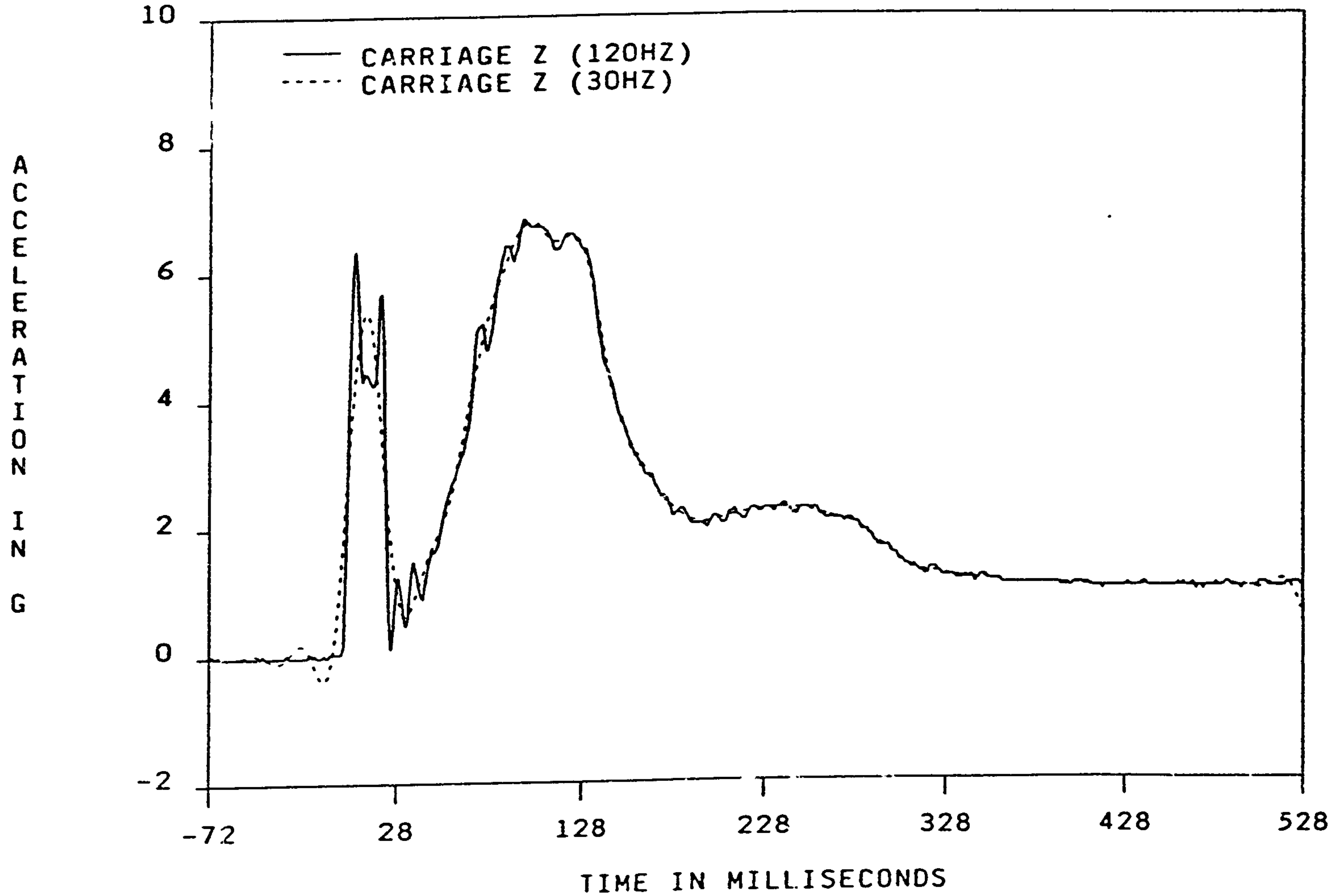
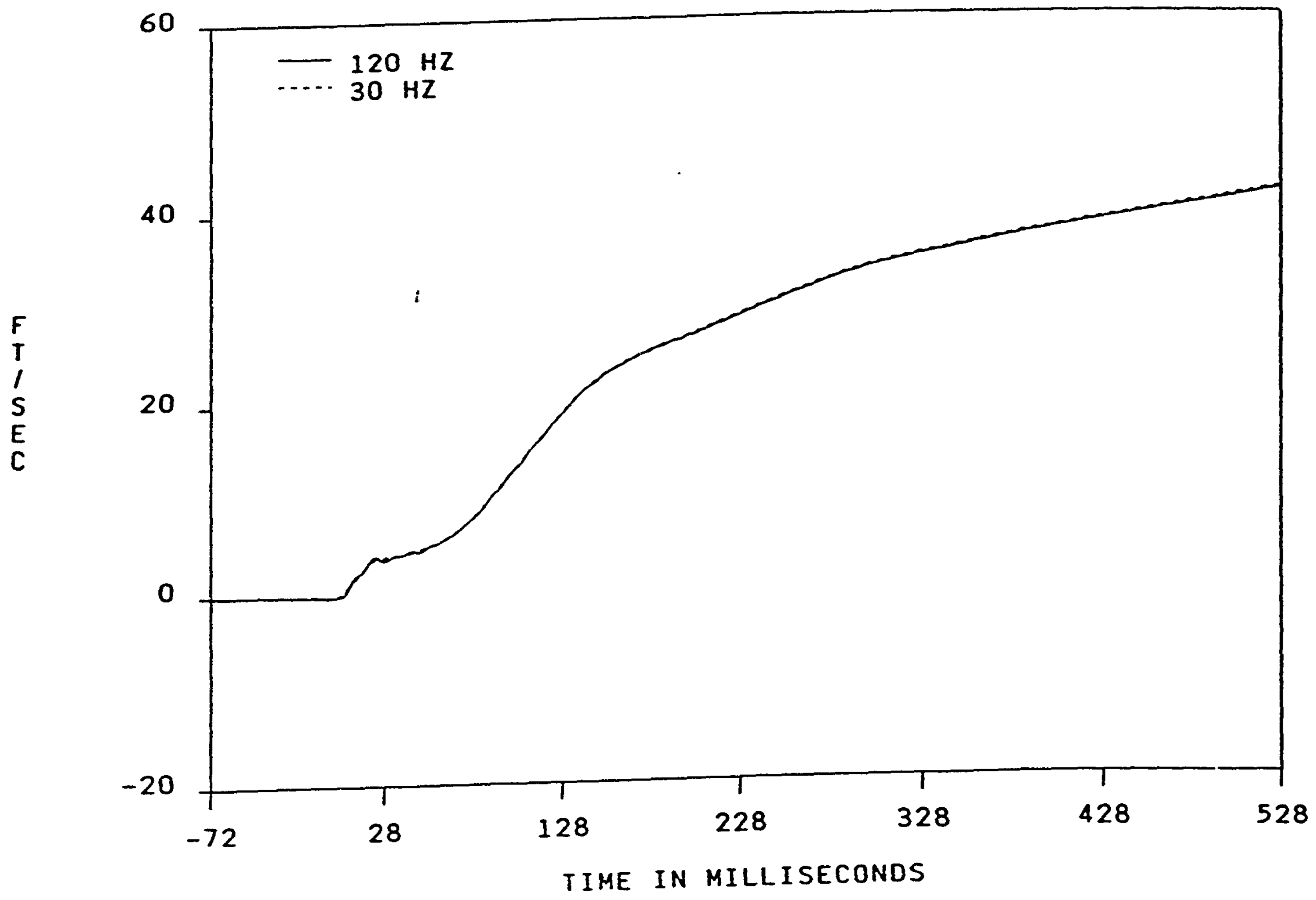


FIGURE 9

TEST 1796 SEAT Z VELOCITY CHANGE



SECTION 4
DISCUSSION

4.1 EXPERIMENTALLY OBSERVED EFFECTS OF DYNAMIC PRELOAD

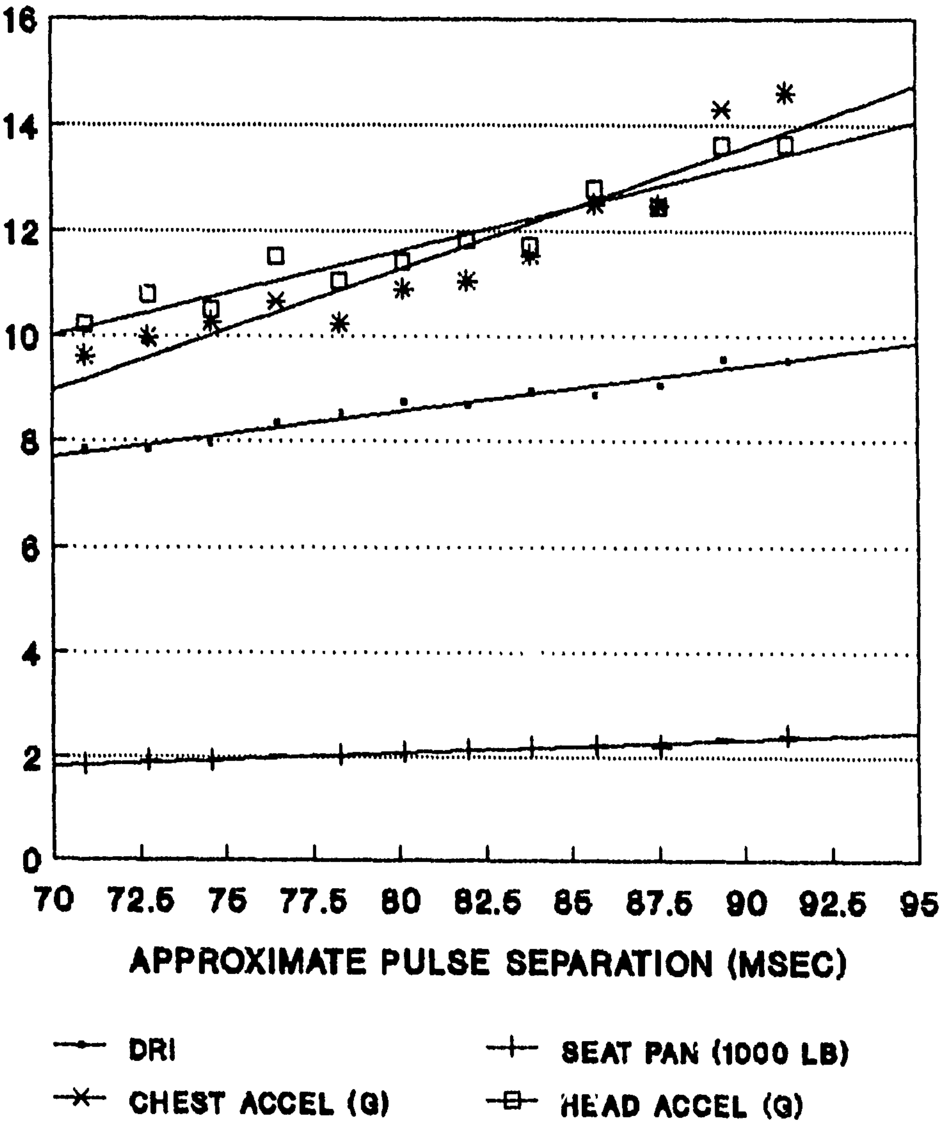
Table 3 is a tabulation of data from selected tests which show the greatest consistency in preload and carriage acceleration. Data for seat accelerations were filtered with a cutoff frequency of 30 Hz. Figure 10 displays some of the data from Table 3 graphically.

TABLE 3. SUMMARY OF DATA FROM SELECTED TESTS
(note: all data refer to effects measured along the Z axis)

TEST	CELL	SEAT PRELOAD (G)	SEAT ACCEL (G)	PULSE SEPARATION (MSEC)	DRI	SEAT PAN LOAD (LB)	LUMBAR LOAD (LB)	CHEST ACCEL (G)	NECK LOAD (LB)	HEAD ACCEL (G)
1790	C1	7.51	7.40	91.2	9.53	2408	964	14.62	147	13.64
1791	D1	7.41	7.53	89.4	9.54	2353	918	14.30	147	13.60
1795	E1	6.30	7.22	87.6	9.06	2197	909	12.48	134	12.47
1796	F1	7.36	7.06	85.7	8.86	2204	919	12.51	138	12.79
1797	G1	6.31	7.35	83.8	8.95	2176	872	11.53	125	11.72
1798	H1	6.89	7.29	82.0	8.68	2113	872	11.03	127	11.82
1799	I1	6.23	7.42	80.2	8.72	2081	853	10.89	121	11.40
1800	J1	5.72	7.29	78.3	8.52	2011	807	10.24	116	11.05
1801	K1	7.00	7.20	76.4	8.33	2017	830	10.65	119	11.51
1805	L1	7.60	7.18	74.6	7.94	1921	724	10.25	107	10.49
1803	M1	8.02	7.10	72.8	7.84	1907	758	9.97	113	10.79
1804	N1	7.57	7.29	70.9	7.83	1841	715	9.61	104	10.21
1809	B1	--	7.12	--	8.86	2010	854	11.30	124	11.44

The data show that, for the range of pulse separations accommodated by the dynamic preload device, at long pulse separations the use of dynamic preload causes an increase in the quantities associated with injury potential when compared with the results of the no-preload case (Test 1809). As the pulse separation decreases a point is reached about midrange where the subject response characteristics are about the same with or without preload. The escape velocity achieved with preload is greater than the no-preload case by an amount approximately

FIGURE 10. SEAT LOAD, DRI, AND MANIKIN RESPONSE FROM SELECTED TESTS



equal to the area of the preload pulse when acceleration is plotted against time. It is not exactly equal to the preload pulse area because the preload and main carriage pulses have begun to merge. As the pulse separation continues to decrease the injury potential indicators also decrease. This would allow one to increase the amplitude of the main plunger pulse (gaining additional escape velocity beyond that provided by the preload alone) and still have a DRI no worse than the baseline case (Test 1809). Figures 11 to 14 show graphically how the DRI changes with decreasing pulse separation.

The pulse separation column in Table 3 contains calculated values from a least-squares curve fit through the actual data. This was necessary because the main carriage pulse peak is flattened and imperfect, and so does not give an accurate picture of pulse separation. Figure 15 is a plot of the data. The slope is 3.7 msec/inch.

4.2 EXTRAPOLATED EFFECTS OF DYNAMIC PRELOAD

The trend lines in Figure 10 suggest that if the pulse separation could be further reduced beyond the limits imposed by the preload device, even greater reductions in the magnitudes of the injury potential indicators could be achieved.

The seat pan acceleration is recorded digitally with a time increment of one millisecond. To examine the effects of reducing the pulse separation beyond what was possible in this experiment, a computer program was written which subtracts a time offset from the points corresponding to the main carriage pulse, "trims away" any points below the intersection of the preload and main plunger pulses, calculates the DRI, and plots the results. Test 1804 (Figure 14) provided the data which served as the starting point. Table 4 summarizes the data.

TABLE 4. EXTRAPOLATION OF TEST DATA

TEST #	PULSE SEPARATION (MSEC)	MAX DRI	VELOCITY CHANGE (FT/SEC)
1809	N/A	8.86	30.9
1805	74.6	7.94	34.9
1804	70.9	7.83	34.6
1804-6 MSEC	64.9	7.47	34.6
1804-12 MSEC	58.9	7.46	34.5
1804-18 MSEC	52.9	8.13	34.2
1804-24 MSEC	46.9	8.85	33.7
1804-30 MSEC	40.9	9.48	33.2

FIGURE 11. DRI FOR TEST 1809

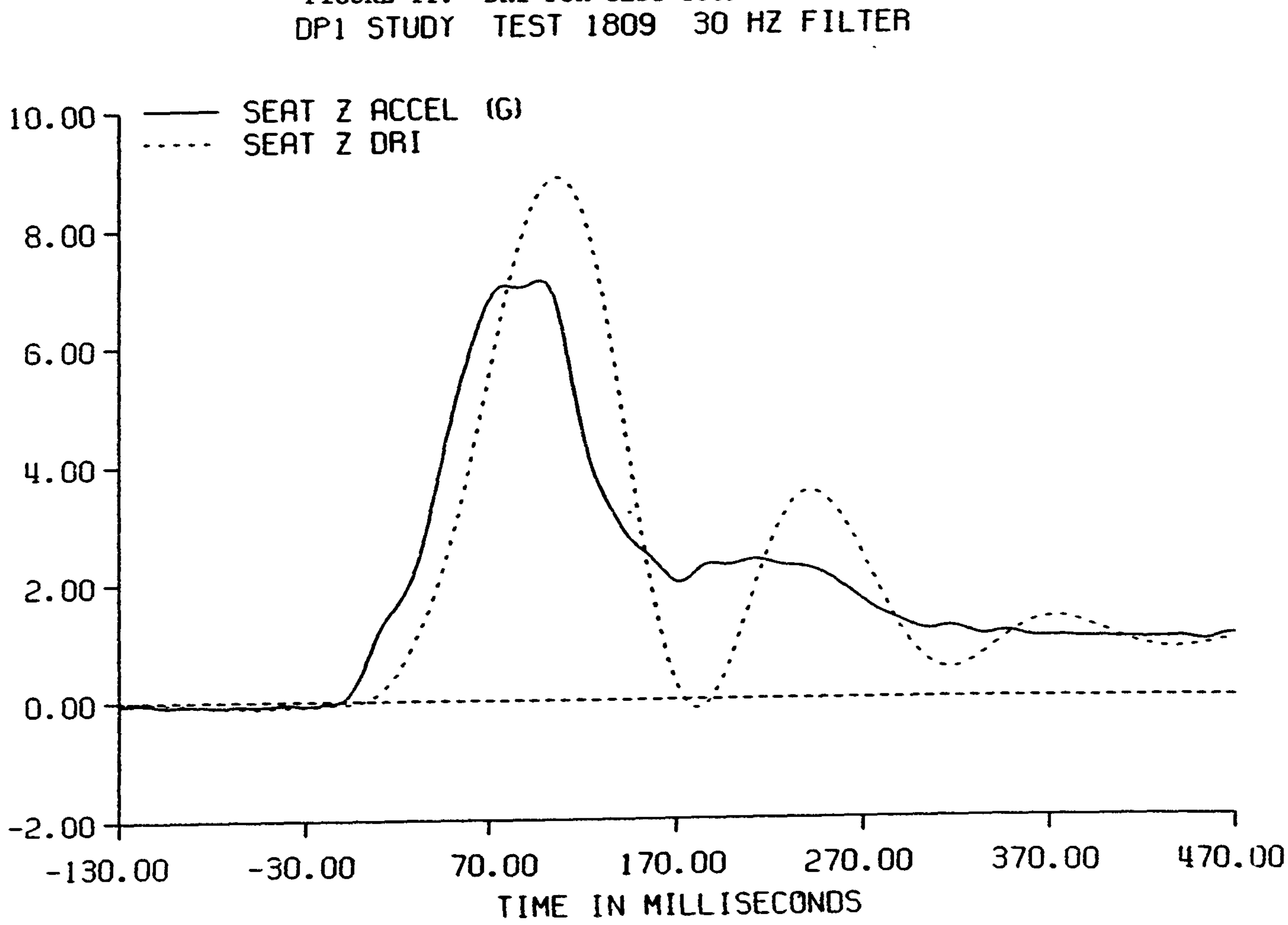


FIGURE 12. DRI FOR TEST 1790

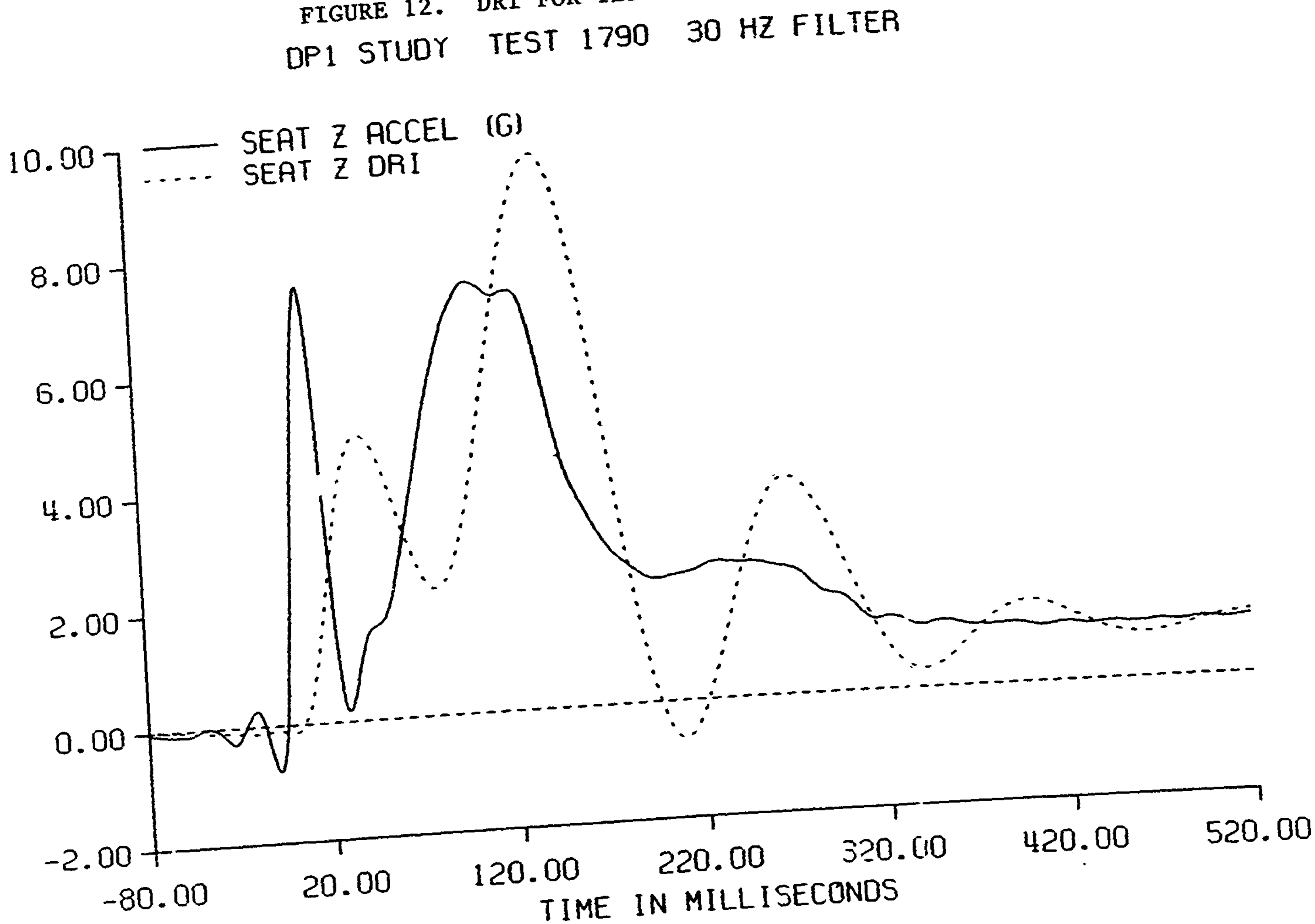


FIGURE 13. DRI FOR TEST 1799

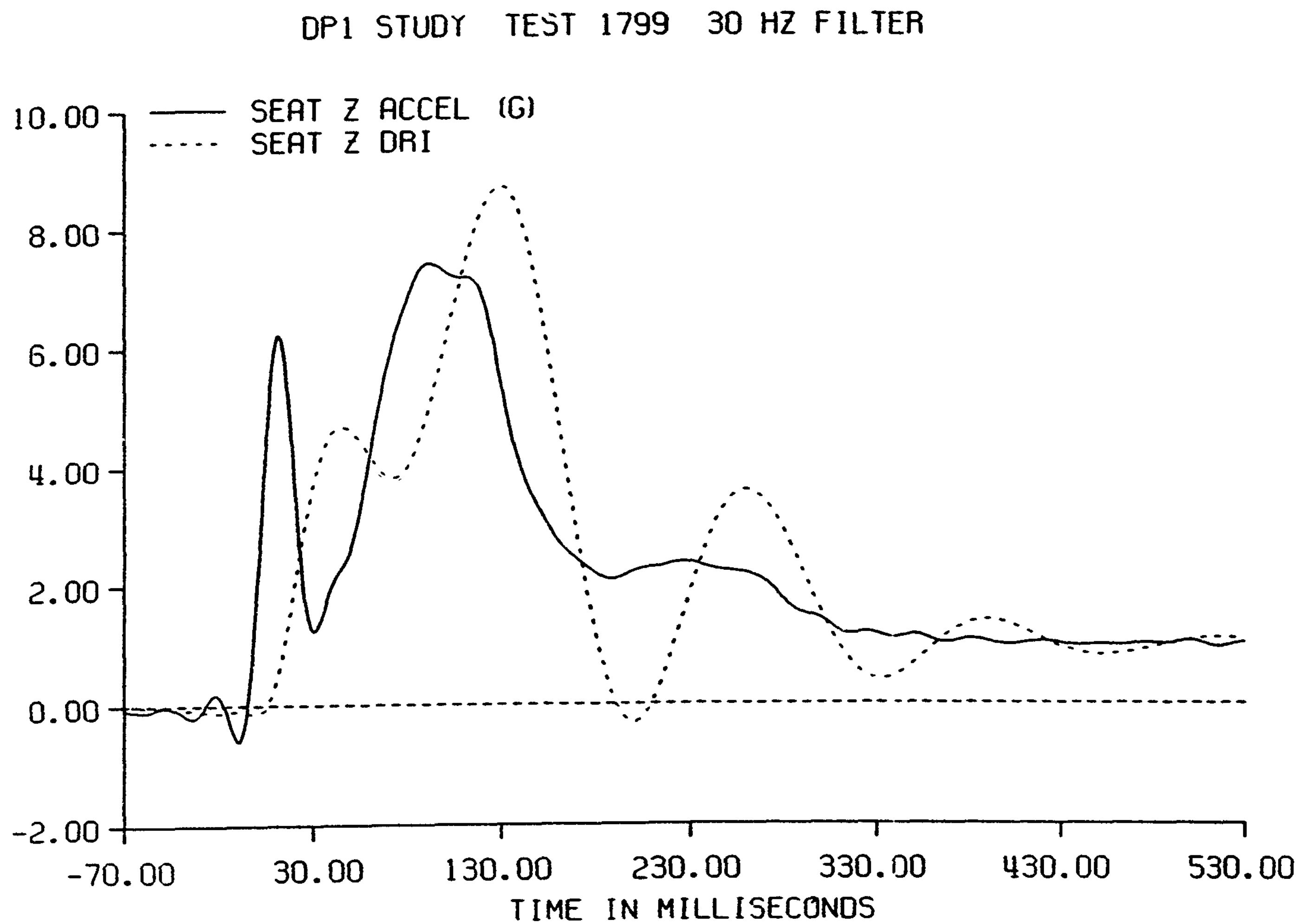


FIGURE 14. DRI FOR TEST 1804

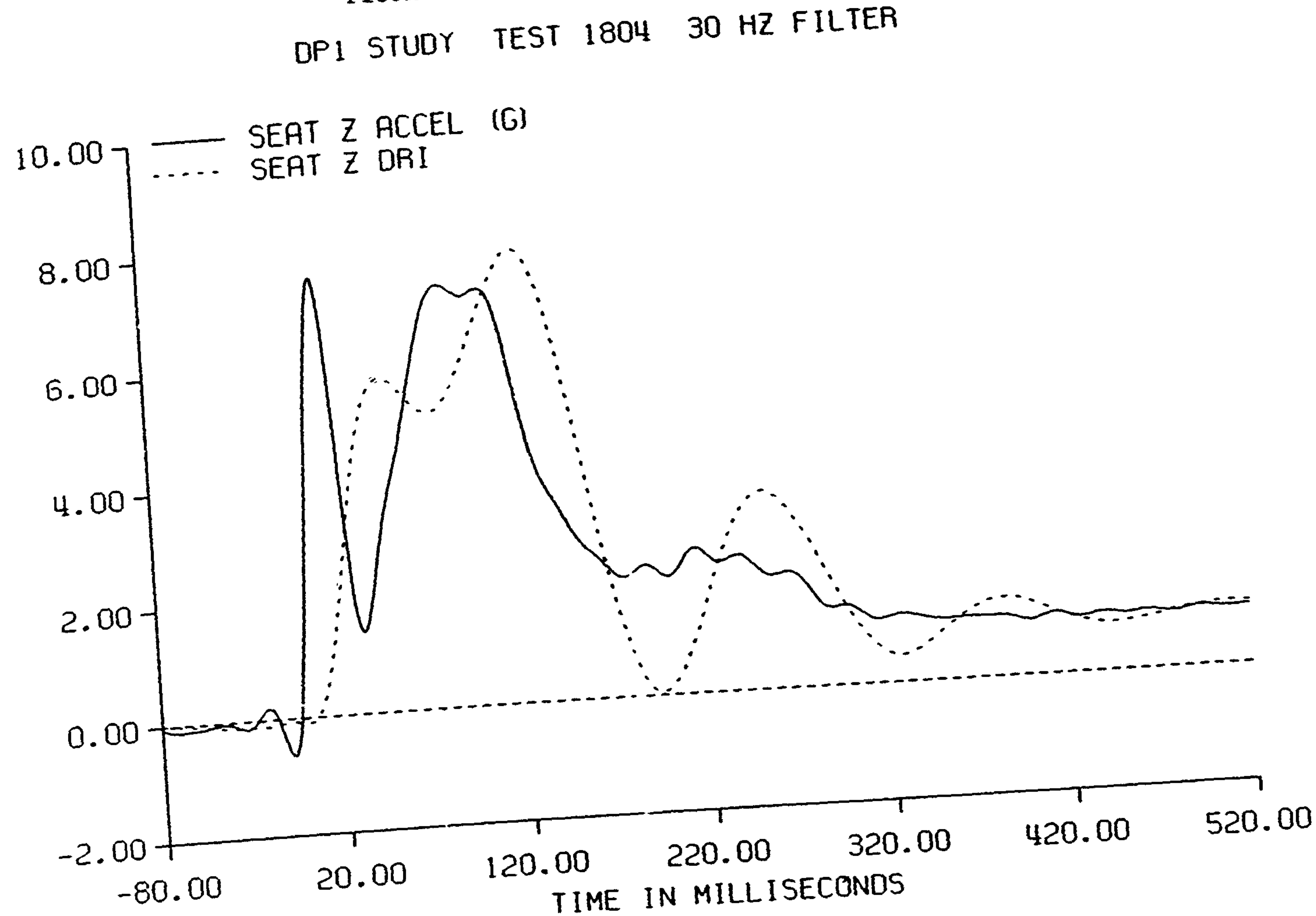
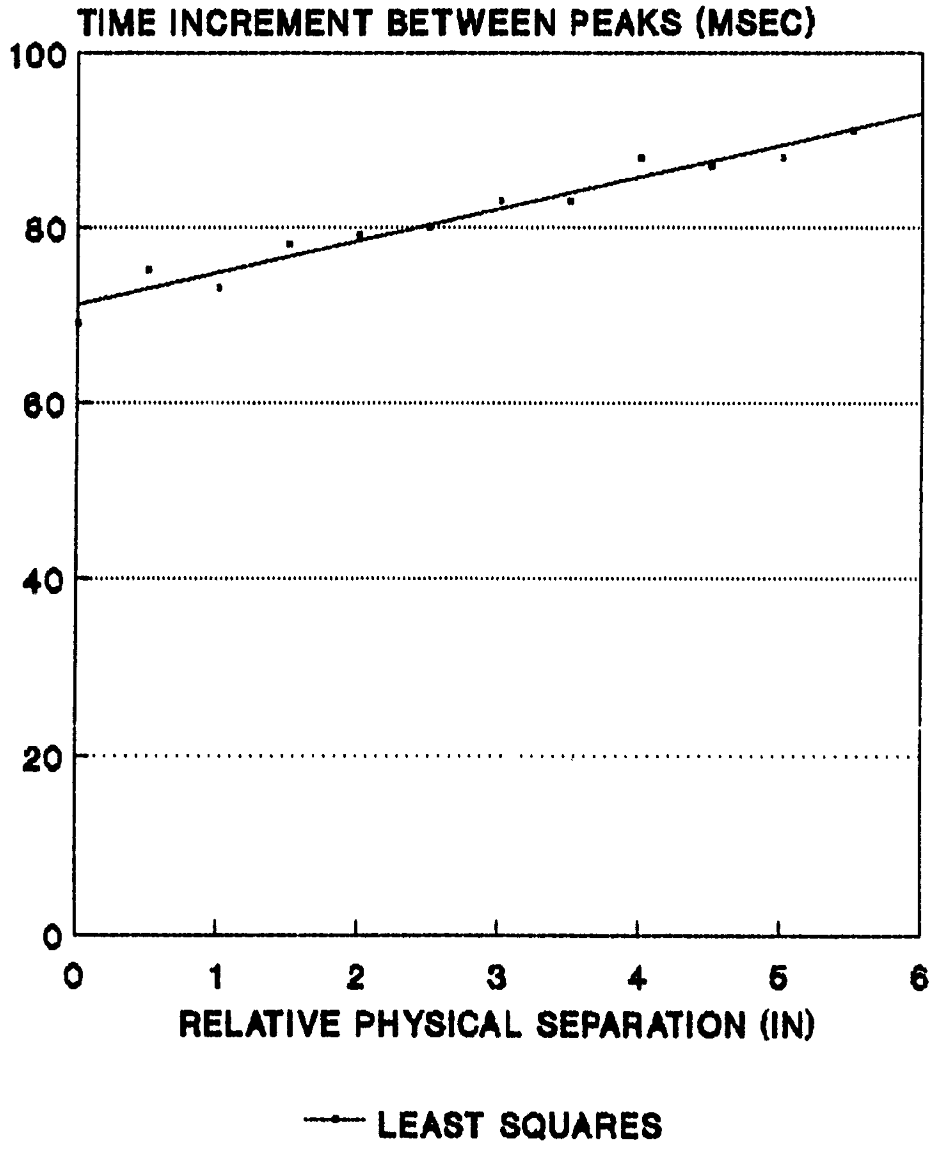


FIGURE 15.

TIME DELTA BETWEEN CELLS FOR SELECTED TEST DATA



The table shows that the DRI falls slowly to a minimum, then rises rapidly. To test at the minimum condition the shear blades on the sled would have to be located about three inches above the current "high" position, with no shims on the specimen holder. This is physically impossible due to space constraints, and of little value since the DRI corresponding to the conditions of Test 1804 is only five percent greater than the minimum. Furthermore, any real system exhibits variability and so attempting to test at the absolute minimum could cause the subject to experience a higher DRI than desired if the pulse timing should be off.

The "change in velocity" column in Table 4 is an approximation for comparison purposes. It represents the integral of a curve such as Figure 14 out to the 300 msec time point. Note that gravity effects are excluded as the curve is "zeroed" for time prior to the preload pulse. The velocity change decreases as the pulse merge, but the corresponding fall in the DRI means that the magnitude of the main plunger pulse could be increased safely, offsetting this.

Figures 16 through 20 display the data of Table 4 graphically. As the pulse separation decreases, the peaks in the DRI merge into one that rises and shifts to the left.

4.3 OPTIMUM PARAMETERS FOR HUMAN TESTS

One of the objectives of this program was to determine test parameters for a follow-on study with human subjects. This study showed that for the preload pulse characteristics used, a pulse separation of 70.9 msec would be suitable. But were these preload pulse characteristics optimum? It is possible to change the magnitude of the preload pulse by changing the web thickness of the shear samples. In the previous section it was mentioned that reducing the pulse separation (up to a point) reduced the magnitude of the DRI, and this would allow the magnitude of the main carriage pulse to be increased. But by how much?

A computer simulation was used to explore these issues. The simulation assumes a preload pulse with the form of an isosceles triangle and a duration of 0.035 seconds, followed by a main carriage pulse modeled as a half-sine pulse with a duration of 0.138 seconds. For the case of no preload pulse, a half-sine pulse of 1 G amplitude and 0.138 second duration would have a DRI of 1.31. The program takes this DRI and the pulse durations to be constants. Then for a preload pulse whose amplitude is a fixed fraction of the half-sine pulse, the program iterates to find the amplitude of the half-sine pulse which will give a DRI of 1.31 for several pulse separations. The first and second integrals of the pulse forms provide the change in velocity and displacement for the parameters used. Since the pulse separation is variable, the integrals were carried out over a time increment of 0.138 seconds to provide a valid comparison.

Table 5 is the output of this program. Since the DRI is held constant, the "best" parameters are those which give the greatest theoretical displacement. This is 3 50 inches and corresponds to a preload pulse amplitude 1.25 times as great as the main pulse amplitude and a pulse separation of 0.070 seconds.

FIGURE 16. DRI FOR EXTRAPOLATED 64.9 MSEC PULSE SEPARATION

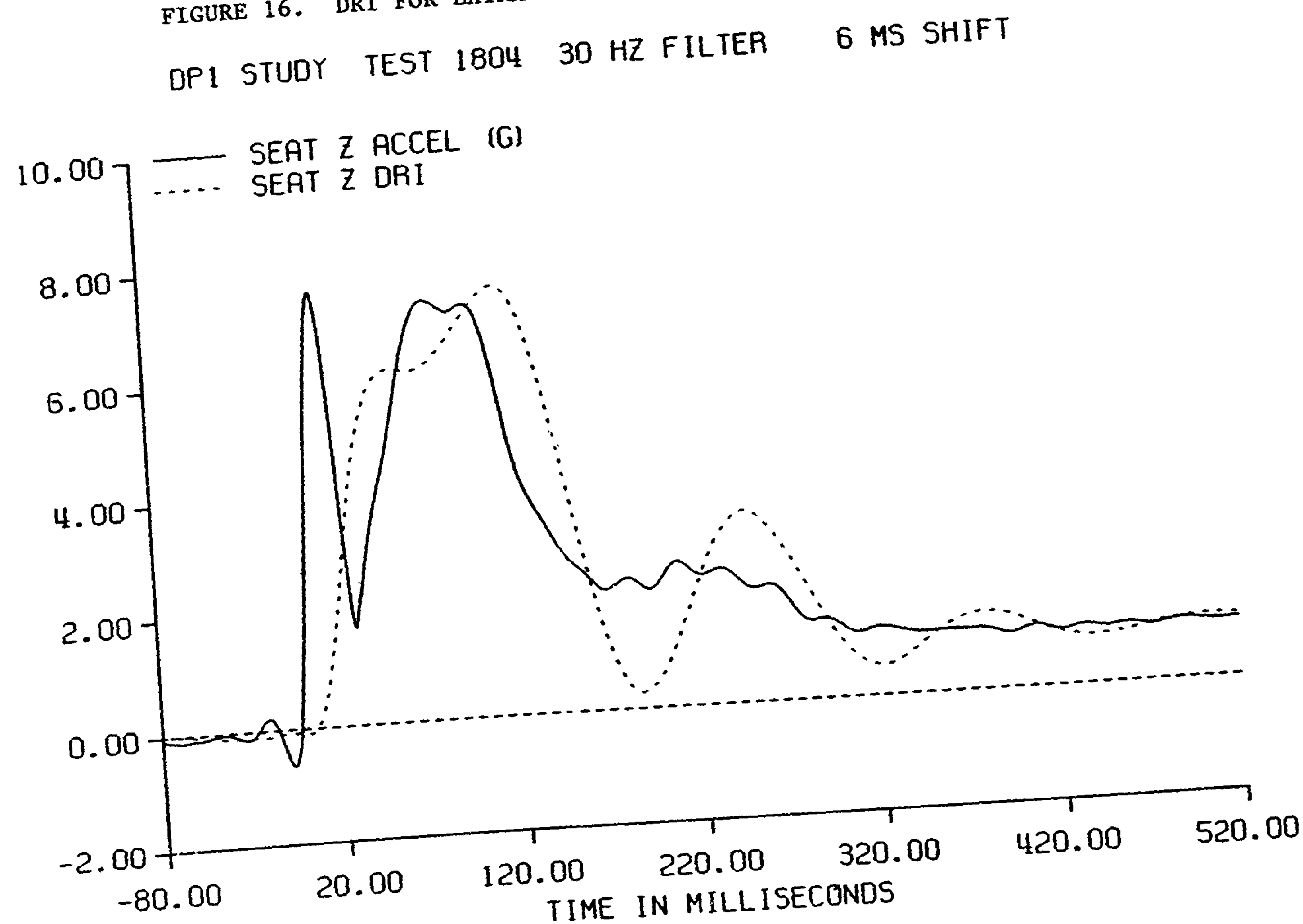


FIGURE 17. DRI FOR EXTRAPOLATED 58.9 MSEC PULSE SEPARATION

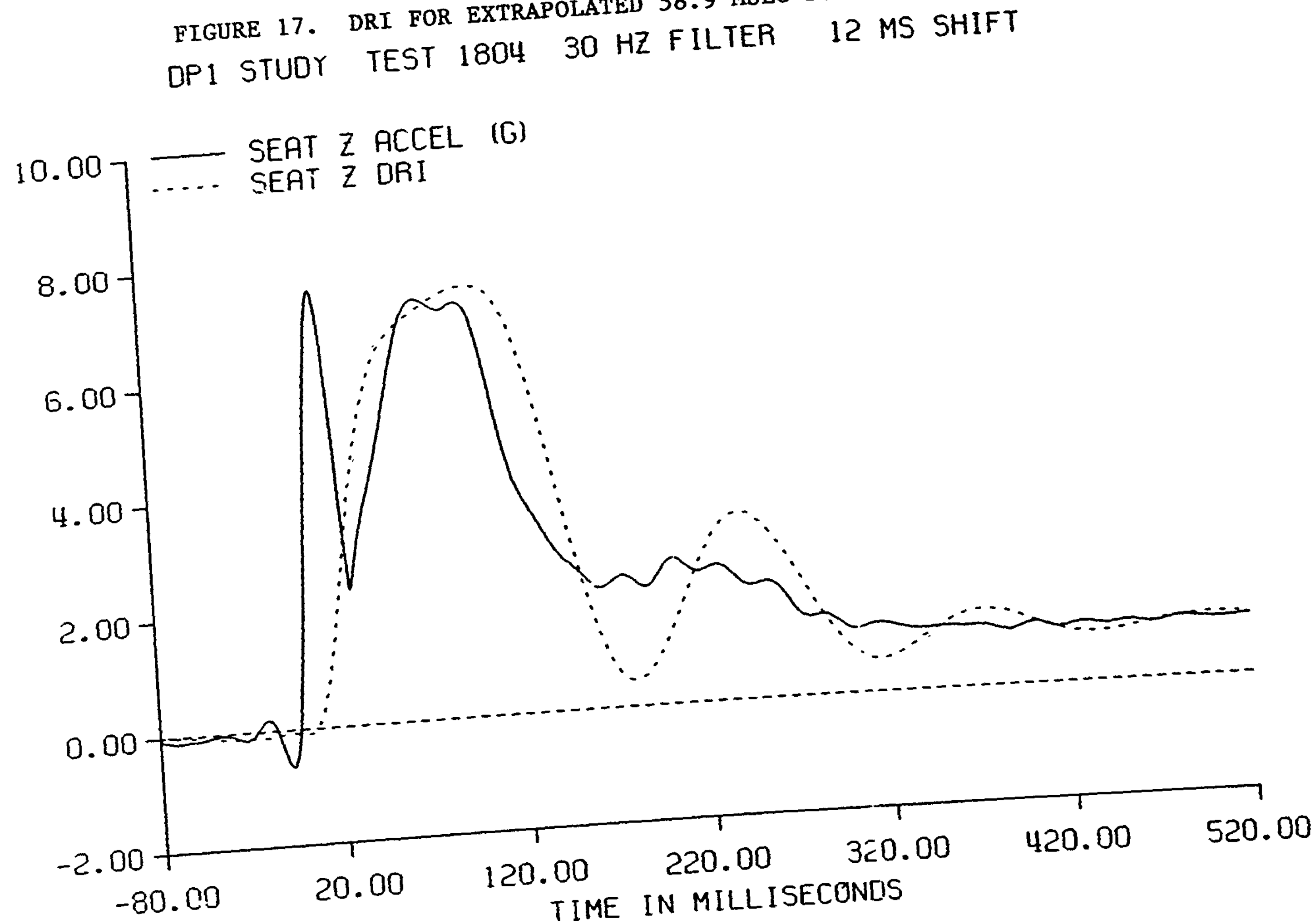


FIGURE 18. DRI FOR EXTRAPOLATED 52.9 MSEC PULSE SEPARATION

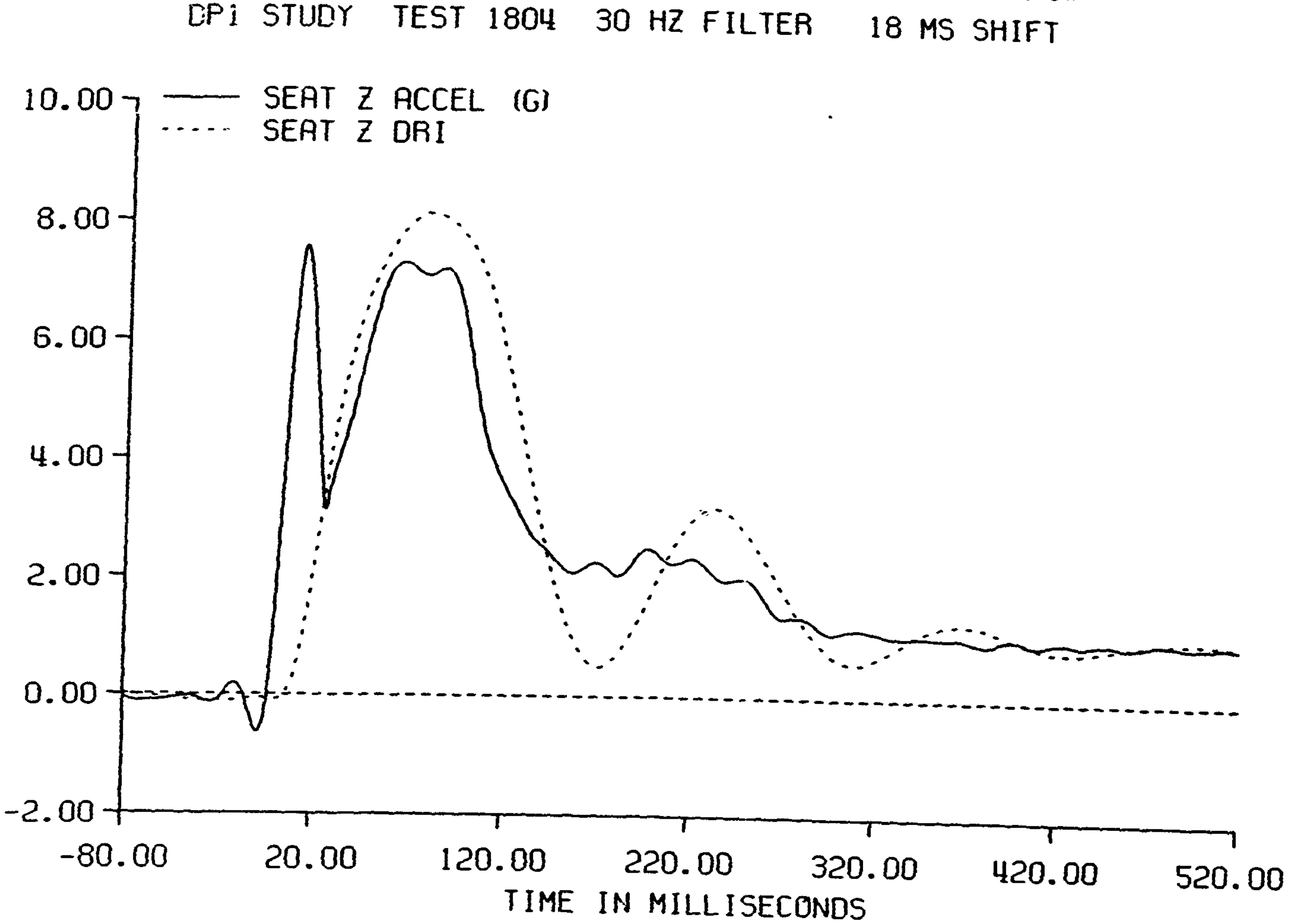


FIGURE 19. DRI FOR EXTRAPOLATED 46.9 MSEC PULSE SEPARATION

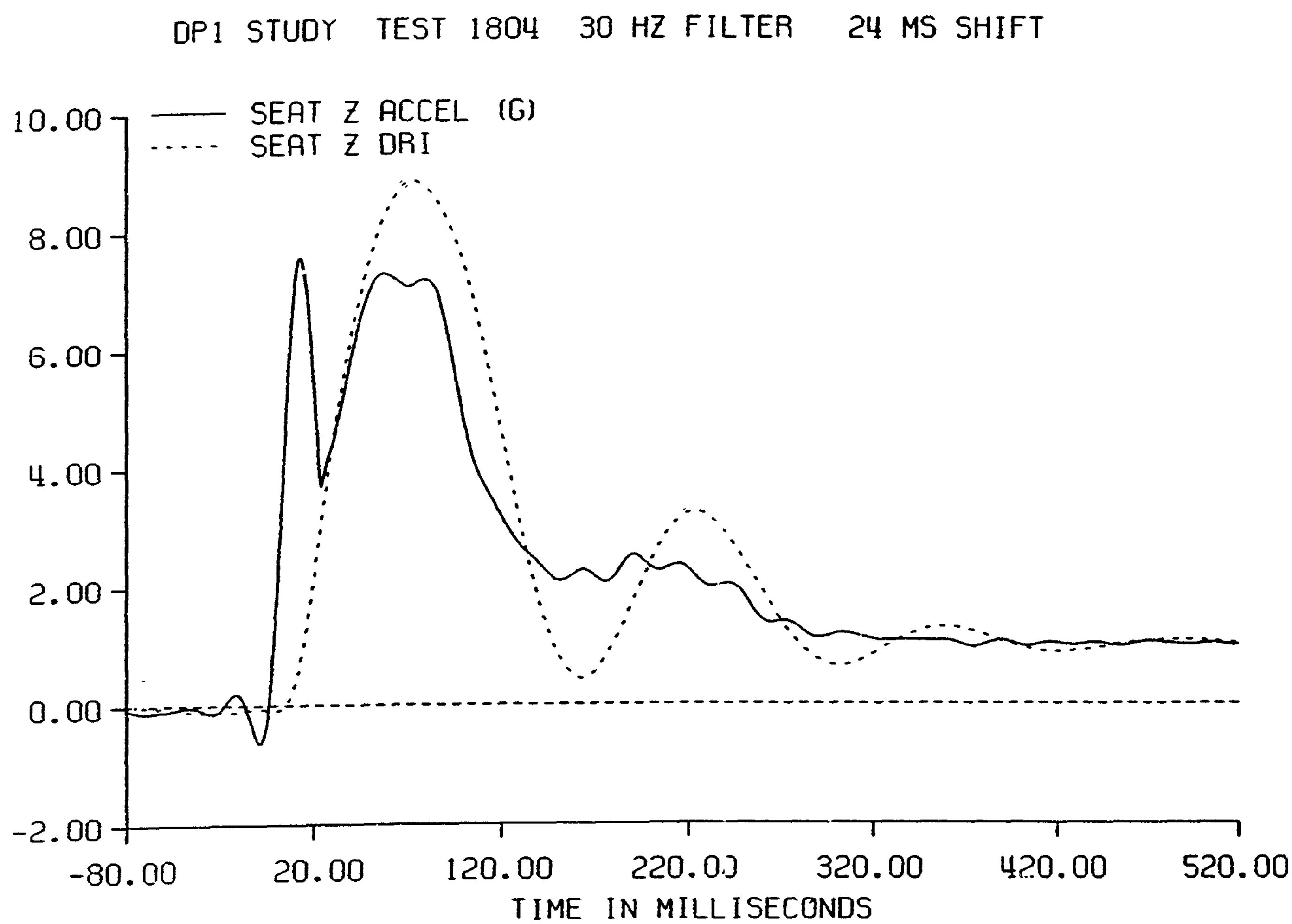


FIGURE 20. DRI FOR EXTRAPOLATED 40.9 MSEC PULSE SEPARATION

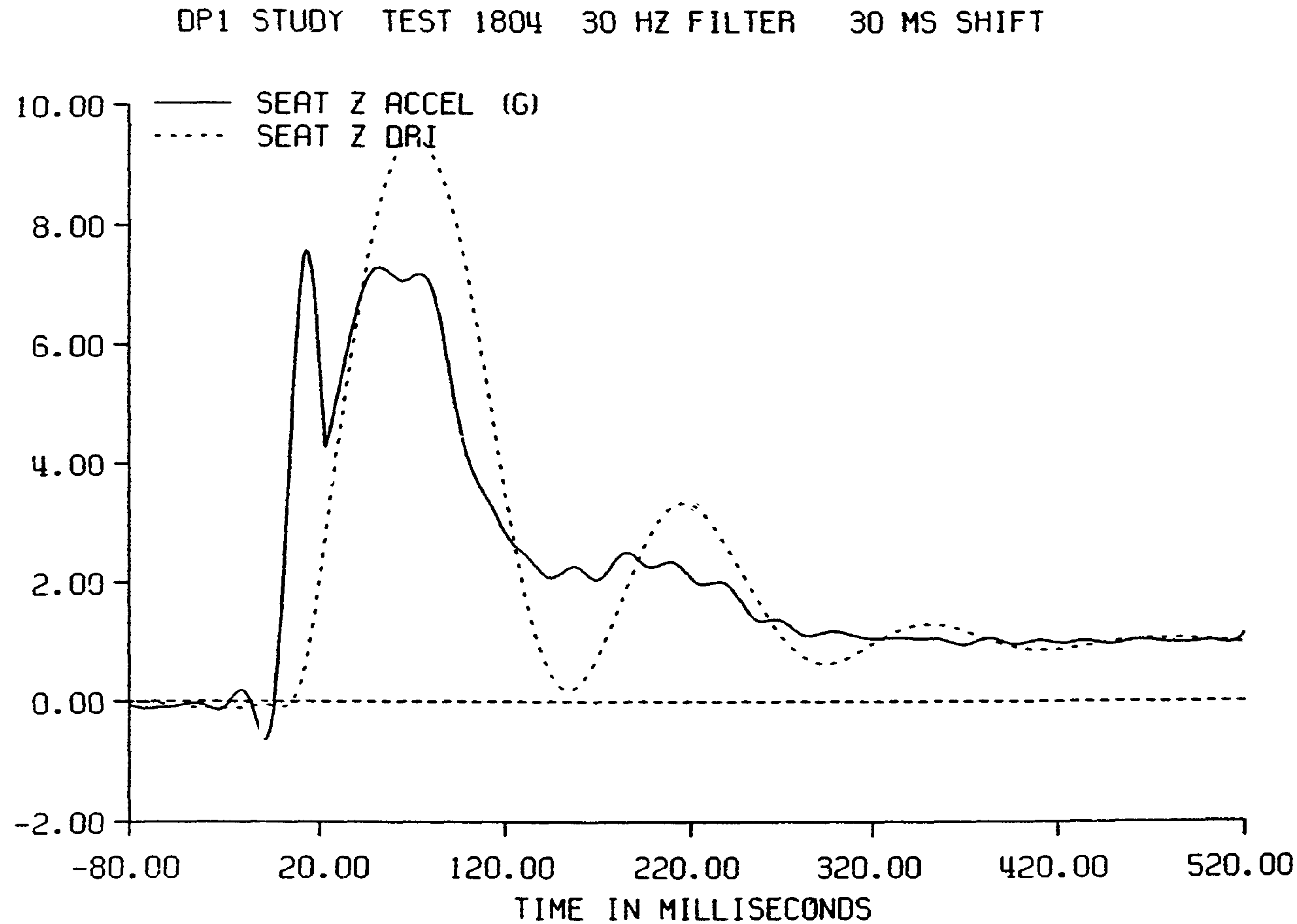


TABLE 5.
DRI MODEL FOR ACCELERATION PROFILE WITH PRELOAD PULSE

PRELOAD PULSE DURATION (SEC) : 0.0350
IMPACT PROFILE DURATION (SEC) : 0.1380
DYNAMIC RESPONSE INDEX : 1.31

PRELOAD PEAK G RATIO	IMPACT PEAK G LEVEL	PEAK TO PEAK SEPARATION TIME (SEC)	VELOCITY CHANGE AT 0.1380 SEC (FT/SEC)	DISPLACEMENT CHANGE AT 0.1380 SEC (INCHES)
0.00	1.00	0.0000	2.83	2.31
0.25	1.02	0.0600	2.89	2.12
0.25	1.03	0.0650	2.93	2.03
0.25	1.04	0.0700	2.92	1.92
0.25	1.05	0.0750	2.88	1.79
0.25	1.05	0.0800	2.79	1.65
0.25	1.04	0.0850	2.67	1.49
0.25	1.03	0.0900	2.52	1.3[illegible]
0.25	1.02	0.0950	2.36	1.16
0.25	1.01	0.1000	2.19	1.04
0.50	1.03	0.0550	2.99	2.38
0.50	1.06	0.0600	3.12	2.36
0.50	1.09	0.0650	3.20	2.32
0.50	1.10	0.0700	3.23	2.23
0.50	1.11	0.0750	3.19	2.11
0.50	1.10	0.0800	3.08	1.94
0.50	1.08	0.0850	2.92	1.76
0.50	1.05	0.0900	2.72	1.57
0.50	1.03	0.0950	2.53	1.40
0.50	1.01	0.1000	2.33	1.24
0.75	1.07	0.0550	3.22	2.64
0.75	1.11	0.0600	3.40	2.67
0.75	1.15	0.0650	3.54	2.67
0.75	1.18	0.0700	3.59	2.60
0.75	1.17	0.0750	3.53	2.46
0.75	1.15	0.0800	3.38	2.26
0.75	1.11	0.0850	3.16	2.04
0.75	1.07	0.0900	2.92	1.81
0.75	1.03	0.0950	2.69	1.61
0.75	1.00	0.1000	2.47	1.44

TABLE 5 continued.

DRI MODEL FOR ACCELERATION PROFILE WITH PRELOAD PULSE

PRELOAD PULSE DURATION (SEC) : 0.0350
IMPACT PROFILE DURATION (SEC) : 0.1380
DYNAMIC RESPONSE INDEX : 1.31

PRELOAD PEAK G RATIO	IMPACT PEAK G LEVEL	PEAK TO PEAK SEPARATION TIME (SEC)	VELOCITY CHANGE AT 0.1380 SEC (FT/SEC)	DISPLACE-MENT CHANGE AT 0.1380 SEC (INCHES)
1.00	1.10	0.0550	3.43	2.90
1.00	1.16	0.0600	3.70	3.00
1.00	1.23	0.0650	3.93	3.07
1.00	1.26	0.0700	4.01	3.02
1.00	1.24	0.0750	3.90	2.84
1.00	1.19	0.0800	3.68	2.59
1.00	1.14	0.0850	3.40	2.32
1.00	1.08	0.0900	3.11	2.05
1.00	1.04	0.0950	2.84	1.82
1.00	1.00	0.1000	2.59	1.63
1.25	1.09	0.0550	3.56	3.09
1.25	1.18	0.0600	3.89	3.26
1.25	1.28	0.0650	4.27	3.45
1.25	1.35	0.0700	4.48	3.50
1.25	1.30	0.0750	4.28	3.25
1.25	1.23	0.0800	3.97	2.92
1.25	1.16	0.0850	3.62	2.59
1.25	1.09	0.0900	3.28	2.28
1.25	1.03	0.0950	2.97	2.03
1.25	0.99	0.1000	2.70	1.81
1.50	1.04	0.0550	3.53	3.14
1.50	1.11	0.0600	3.81	3.27
1.50	1.17	0.0650	4.07	3.39
1.50	1.24	0.0700	4.28	3.46
1.50	1.29	0.0750	4.42	3.47
1.50	1.26	0.0800	4.24	3.24
1.50	1.17	0.0850	3.82	2.85
1.50	1.09	0.0900	3.43	2.50
1.50	1.03	0.0950	3.09	2.22
1.50	0.97	0.1000	2.81	1.99

TABLE 5 continued.

DRI MODEL FOR ACCELERATION PROFILE WITH PRELOAD PULSE

PRELOAD PULSE DURATION (SEC) : 0.0350
IMPACT PROFILE DURATION (SEC) : 0.1380
DYNAMIC RESPONSE INDEX : 1.31

PRELOAD PEAK G RATIO	IMPACT PEAK G LEVEL	PEAK TO PEAK SEPARATION TIME (SEC)	VELOCITY CHANGE AT 0.1380 SEC (FT/SEC)	DISPLACEMENT CHANGE AT 0.1380 SEC (INCHES)
1.75	0.97	0.0550	3.40	3.10
1.75	1.01	0.0600	3.61	3.18
1.75	1.05	0.0650	3.79	3.24
1.75	1.09	0.0700	3.93	3.27
1.75	1.12	0.0750	4.01	3.25
1.75	1.15	0.0800	4.03	3.19
1.75	1.17	0.0850	3.99	3.09
1.75	1.08	0.0900	3.57	2.71
1.75	1.02	0.0950	3.21	2.40
1.75	0.96	0.1000	2.90	2.15
2.00	0.89	0.0550	3.24	3.01
2.00	0.92	0.0600	3.40	3.07
2.00	0.94	0.0650	3.53	3.10
2.00	0.97	0.0700	3.63	3.10
2.00	0.99	0.0750	3.68	3.07
2.00	1.01	0.0800	3.68	3.01
2.00	1.03	0.0850	3.64	2.91
2.00	1.03	0.0900	3.55	2.79
2.00	1.00	0.0950	3.31	2.57
2.00	0.95	0.1000	2.99	2.31

TABLE 6.

DRI MODEL FOR ACCELERATION PROFILE WITH PRELOAD PULSE

IMPACT G LEVEL : 1.00
IMPACT PROFILE DURATION (SEC) : 0.1380
PRELOAD PULSE DURATION (SEC) : 0.0350

PRELOAD PEAK G LEVEL	PEAK TO PEAK SEPARATION TIME (SEC)	DYNAMIC RESPONSE INDEX	VELOCITY CHANGE AT 0.1380 SEC (FT/SEC)	DISPLACE-MENT CHANGE AT 0.1380 SEC (INCHES)
0.00	0.0000	1.31	2.83	2.31
0.25	0.0600	1.29	2.84	2.08
0.25	0.0650	1.27	2.83	1.97
0.25	0.0700	1.25	2.80	1.84
0.25	0.0750	1.25	2.74	1.71
0.25	0.0800	1.25	2.66	1.57
0.25	0.0850	1.26	2.56	1.43
0.25	0.0900	1.27	2.45	1.29
0.25	0.0950	1.29	2.32	1.16
0.25	0.1000	1.30	2.18	1.03
0.50	0.0550	1.27	2.90	2.31
0.50	0.0600	1.23	2.94	2.23
0.50	0.0650	1.20	2.94	2.13
0.50	0.0700	1.19	2.92	2.02
0.50	0.0750	1.18	2.88	1.90
0.50	0.0800	1.19	2.80	1.77
0.50	0.0850	1.21	2.70	1.63
0.50	0.0900	1.24	2.59	1.49
0.50	0.0950	1.27	2.46	1.36
0.50	0.1000	1.30	2.32	1.23
0.75	0.0550	1.23	3.01	2.47
0.75	0.0600	1.18	3.05	2.40
0.75	0.0650	1.14	3.07	2.31
0.75	0.0700	1.11	3.05	2.21
0.75	0.0750	1.12	3.01	2.09
0.75	0.0800	1.14	2.94	1.97
0.75	0.0850	1.18	2.85	1.83
0.75	0.0900	1.22	2.73	1.69
0.75	0.0950	1.27	2.60	1.56
0.75	0.1000	1.31	2.46	1.43

TABLE 6 continued.

DRI MODEL FOR ACCELERATION PROFILE WITH PRELOAD PULSE

IMPACT G LEVEL : 1.00
IMPACT PROFILE DURATION (SEC) : 0.1380
PRELOAD PULSE DURATION (SEC) : 0.0350

PRELOAD PEAK G LEVEL	PEAK TO PEAK SEPARATION TIME (SEC)	DYNAMIC RESPONSE INDEX	VELOCITY CHANGE AT 0.1380 SEC (FT/SEC)	DISPLACEMENT CHANGE AT 0.1380 SEC (INCHES)
1.00	0.0550	1.19	3.13	2.64
1.00	0.0600	1.13	3.18	2.58
1.00	0.0650	1.07	3.20	2.50
1.00	0.0700	1.04	3.19	2.40
1.00	0.0750	1.06	3.15	2.29
1.00	0.0800	1.10	3.08	2.17
1.00	0.0850	1.15	2.99	2.03
1.00	0.0900	1.21	2.87	1.89
1.00	0.0950	1.26	2.74	1.76
1.00	0.1000	1.31	2.60	1.63
1.25	0.0550	1.20	3.25	2.82
1.25	0.0600	1.11	3.31	2.77
1.25	0.0650	1.02	3.33	2.69
1.25	0.0700	0.97	3.32	2.60
1.25	0.0750	1.01	3.29	2.49
1.25	0.0800	1.06	3.22	2.37
1.25	0.0850	1.13	3.13	2.24
1.25	0.0900	1.20	3.01	2.10
1.25	0.0950	1.27	2.88	1.96
1.25	0.1000	1.33	2.74	1.84
1.50	0.0550	1.25	3.38	3.01
1.50	0.0600	1.18	3.44	2.96
1.50	0.0650	1.12	3.47	2.89
1.50	0.0700	1.06	3.46	2.80
1.50	0.0750	1.01	3.43	2.69
1.50	0.0800	1.04	3.36	2.57
1.50	0.0850	1.12	3.27	2.44
1.50	0.0900	1.20	3.15	2.30
1.50	0.0950	1.28	3.02	2.16
1.50	0.1000	1.34	2.88	2.04

TABLE 6 continued.

DRI MODEL FOR ACCELERATION PROFILE WITH PRELOAD PULSE

IMPACT G LEVEL : 1.00
IMPACT PROFILE DURATION (SEC) : 0.1380
PRELOAD PULSE DURATION (SEC) : 0.0350

PRELOAD PEAK G LEVEL	PEAK TO PEAK SEPARATION TIME (SEC)	DYNAMIC RESPONSE INDEX	VELOCITY CHANGE AT 0.1380 SEC (FT/SEC)	DISPLACE-MENT CHANGE AT 0.1380 SEC (INCHES)
1.75	0.0550	1.36	3.52	3.20
1.75	0.0600	1.30	3.58	3.15
1.75	0.0650	1.25	3.60	3.08
1.75	0.0700	1.20	3.60	3.00
1.75	0.0750	1.17	3.57	2.89
1.75	0.0800	1.14	3.50	2.77
1.75	0.0850	1.12	3.41	2.64
1.75	0.0900	1.21	3.29	2.50
1.75	0.0950	1.29	3.16	2.37
1.75	0.1000	1.36	3.02	2.24
2.00	0.0550	1.48	3.65	3.40
2.00	0.0600	1.43	3.71	3.35
2.00	0.0650	1.39	3.74	3.28
2.00	0.0700	1.35	3.74	3.20
2.00	0.0750	1.32	3.71	3.09
2.00	0.0800	1.30	3.64	2.97
2.00	0.0850	1.28	3.55	2.84
2.00	0.0900	1.27	3.43	2.70
2.00	0.0950	1.31	3.30	2.57
2.00	0.1000	1.38	3.16	2.44

For the preferred choice of parameters, taking as a baseline case a 6 G drop with no preload on the vertical deceleration tower, the preloaded run would have a preload amplitude of 10 G, a main carriage pulse of 8 G, and be run as Cell N1. The improvement in the theoretical escape displacement should be about 50% with no increase in DRI.

To determine how well the computer model can be used to predict actual preload device performance, the computer program was changed slightly. The main carriage pulse was held constant at 1 G, and the DRI was allowed to vary. The results are given in Table 6. These data can be scaled and compared with the data in Tables 3 and 4. Table 7 shows the results. The comparison must be made for the case with the preload pulse amplitude ratio equal to one. It must be assumed that a good correlation here would imply the Table 6 data for other amplitude ratios are accurate.

TABLE 7. COMPARISON OF TEST DATA WITH A COMPUTER MODEL

DATA FROM TABLES 3 AND 4				SCALED DATA FROM TABLE 6			
PULSE SEPARATION MSEC	PRELOAD PULSE AMPLITUDE G	MAIN PULSE AMPLITUDE G	DRI	PULSE SEPARATION MSEC	PRELOAD PULSE AMPLITUDE G	MAIN PULSE AMPLITUDE G	DRI
89.4	7.51	7.40	9.53	90	7.40	7.40	8.95
80.2	6.23	7.42	8.72	80	7.42	7.42	8.16
70.9	7.57	7.29	7.83	70	7.29	7.29	7.58
58.9*	7.57	7.29	7.46	60	7.29	7.29	8.23
52.9*	7.57	7.29	8.13	55	7.29	7.29	8.68
0	0	7.12	8.86	0	0	7.12	9.33

*extrapolated from Test 1804

The computer model gives reasonably good results, but predicts the DRI to begin to rise somewhat earlier as pulse separation is decreased. The experimental and modeled amplitudes are not identical, but then neither are the real and idealized pulse shapes. These results are enough to confirm that the parameters recommended above would be a good choice for human testing.

4.4 FUNCTIONAL CAPABILITY AND STRUCTURAL ADEQUACY OF THE DYNAMIC PRELOAD DEVICE

The preload device performed well, with the variability seen in the amplitude of the preload pulse attributed to nonuniformity of the test

specimens. The sheared surfaces of the specimens from most tests showed a regular sawtooth pattern, and the chips generated by the impact were pellets about one-half inch long. In other tests portions of the sheared surfaces on the specimens were smooth where slivers an inch or more in length had broken out. These slivers were associated with tests which failed to achieve the desired preload amplitude.

The device has sufficient adjustment capability for testing at the parameters selected for human tests.

A total of 33 tests (including uninstrumented calibration tests) were conducted using the Dynamic Preload Device. Cracks were noticed in the shear sample holders approximately half way through this test series, and the program was terminated when one of the shear sample holders failed completely (Figure 21). This poses no danger as the specimen is held in place by the magazine encasing the sample holder. There is little that can be done to prevent this as thickening those portions of the sample holder where space constraints allow is likely to cause the failure location to shift to other areas that cannot be modified. By making "spare" holders, no delays should be caused in a follow-on human program.

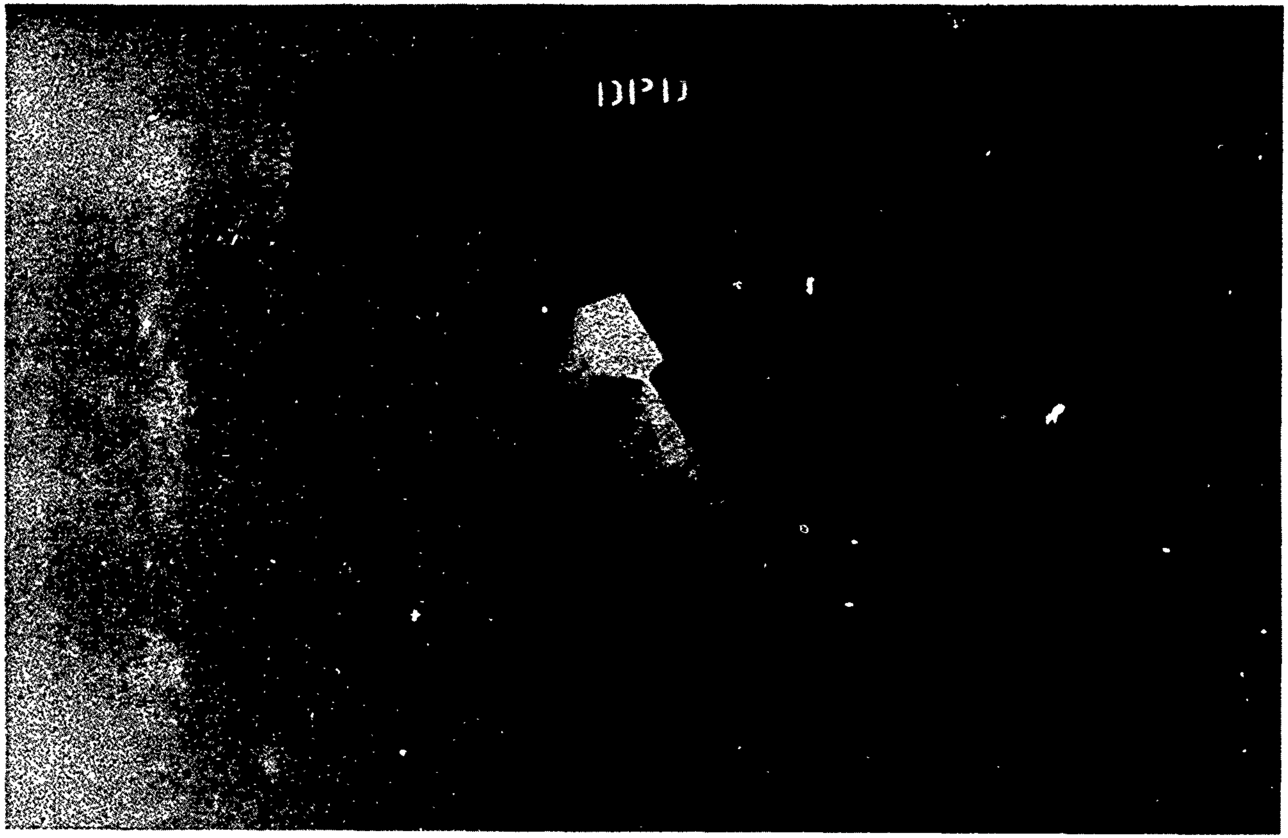


FIGURE 21. FAILED SHEAR SAMPLE HOLDER

SECTION 5
SUMMARY AND RECOMMENDATIONS

5.1 SUMMARY

Twenty-eight fully instrumented tests were conducted in this program, of which 25 used the Dynamic Preload Device. Analysis of the data and computer simulations showed that use of dynamic preload could provide significant benefits if incorporated in a crew escape system. The device works well, but there is some variability in the results. This is thought to be caused by nonuniformity of the test specimens. Cracking appeared in the shear sample holders after approximately 18 tests, but the device continued to perform well until one of the sample holders failed completely after 33 tests. Failure poses no safety problems as the holder is contained by the magazine.

5.2 RECOMMENDATIONS

Human tests should be run using the parameters given in Section 4.3 for comparison with baseline tests of 6 G with no preload. Extra magazine holders should be fabricated to compensate for the limited life of these parts.

SECTION 6
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APPENDIX A

TEST CONFIGURATION AND DATA ACQUISITION SYSTEM FOR A PARAMETRIC STUDY USING THE DYNAMIC PRELOAD DEVICE - PHASE I DURING +Gz IMPACT ACCELERATIONS (DP1 STUDY) TEST PROGRAM

Prepared under
Contract F33615-86-C-0531

May 1990

Prepared by
Marshall Z. Miller
and
Stephen E. Mosher

DynCorp
Scientific Support Division
Building 824, Area B
Wright-Patterson AFB, Ohio 45433

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INTRODUCTION

This report was prepared by DynCorp for the Harry G. Armstrong Aerospace Medical Research Laboratory (AAMRL/BBP) under Air Force Contract F33615-86-C-0531.

The information provided herein describes the test facility, seat fixture, dynamic preload device, restraint configuration, test subjects, data acquisition and instrumentation procedures that were used in A Parametric Study Using the Dynamic Preload Device - Phase I During +Gz Impact Accelerations (DP1 Study) Test Program. Thirty-six tests were conducted during March 1990 on the Vertical Deceleration Tower Test Facility.

1. TEST FACILITY

The AAMRL Vertical Deceleration Tower was used for all of the tests.

The facility consists of a 60 foot vertical steel tower which supports a guide rail system, an impact carriage supporting a plunger, a hydraulic deceleration device and a test control and safety system. The impact carriage can be raised to a maximum height of 42 feet prior to release. After release, the carriage free falls until the plunger, attached to the undercarriage, enters a water filled cylinder mounted at the base of the tower. The deceleration profile produced as the plunger displaces the water in the cylinder is determined by the free fall distance, the carriage and test specimen mass, the shape of the plunger and the size of the cylinder orifice. A rubber bumper is used to absorb the final impact as the carriage stops. For these tests, plunger number 102 was mounted under the carriage. Drop height varied depending on the test cell requirements which ranged from 5'6" to 12'0".

2. SEAT FIXTURE

The VIP seat fixture, as shown in Figure A-1, was used for all of the tests. The seat was designed to withstand vertical impact accelerations up to 50 G. Its adjustable seat back and seat pan were not adjusted during this study as all of the tests were run at the 0 degree seat back angle. When positioned in the seat, the subject's upper legs were bent 90 degrees outward to a horizontal position with his lower legs bent 90 degrees downward to a vertical position. The subject was secured in the seat with a conventional two-strap shoulder harness and lap belt. The lap belt and shoulder strap were preloaded to 20 ±5 pounds as required in the test plan.

Each of the subject's legs were restrained by a strap that encircled the subject's ankle and was attached to the carriage. Another strap crossed the subject's thighs and attached to the seat pan posterior to the knees. The subject's hands were placed under the thigh restraint. These restraints are illustrated by Figure A-2.

3. DYNAMIC PRELOAD DEVICE

The dynamic preload device consisted of a blade, shear sample holder and shear sample. Attached to each side of the carriage is a blade. The blade has a vertical adjustment capability of $\pm$ 2 inches. Figure A-3 illustrates the dynamic preload device blade and Figure A-4 shows the blade installed on the side of the carriage.

Attached to each rail is a magazine containing a shear sample holder and a shear sample. The shear samples were made from 7075-T6 aluminum blocks 6.8 inches long. The block cross section was 1.50 inches by 0.75 inches. A 0.75 inch wide channel was milled out of the length of the block leaving a web thickness of 0.285 inches. Figure A-5 shows a shear sample and shear sample holder. Attached to the bottom of the shear sample holder in Figure A-5 are shims which allow an adjustment of the vertical position of the shear sample of up to 1.75 inches.

Figure A-6 shows the complete test setup. The blades on the carriage are just entering the tops of the sample holders (which serve to guide the blades) prior to shearing the sample.

4. TEST SUBJECTS

Manikin test subjects were used during this test program.

A 95th percentile Alderson manikin, designated VIP-95, was used for structural and equipment proof tests.

An ADAM manikin representative of the "large" flying population was also used during this test program to measure the dynamic response for various preload conditions.

5. INSTRUMENTATION

The electronic data collected during this test program is described in Sections 5.1 and 5.2. Section 5.1 discusses accelerometers while Section 5.2 discusses load transducers. Section 5.3 discusses the calibration procedures that were used. The measurement instrumentation used in this test program is listed in Tables A-1a through A-1d. These figures designate the manufacturer, type, serial number, sensitivity and other pertinent data on each transducer used. Table A-2 lists the manufacturer's typical transducer specifications.

Accelerometers and load transducers were chosen to provide the optimum resolution over the expected test load range. Full scale data ranges were chosen to provide the expected full scale range plus 50% to assure the capture of peak signals. All transducer bridges were balanced for zero output prior to the start of each test. The accelerometers were adjusted for the effect of gravity using computer processing software.

The component of a 1 G vector in line with the force of gravity that lies along the accelerometer axis was added to each accelerometer.

The accelerometer and load transducer coordinate systems are shown in Figure A-7. The seat coordinate system is right-handed with the z axis parallel to the seat back and positive upward. The x axis is perpendicular to the z axis and positive eyes forward from the subject. The y axis is perpendicular to the x and z axes according to the right hand rule. The origin of the seat coordinate system is designated as the seat reference point (SRP). The SRP is at the midpoint of the line segment formed by the intersection of the seat pan and seat back. All vector components (for accelerations, angular accelerations, forces, moments, etc.) were positive when the vector component (x, y and z) was in the direction of the positive axis.

The linear accelerometers were wired to provide a positive output voltage when the acceleration experienced by the accelerometer was applied in the +x, +y and +z directions, as shown in Figure A-7.

The angular Ry accelerometers were wired to provide a positive output voltage when the angular acceleration experienced by the angular accelerometer was applied in the +y direction according to the right hand rule, as shown in Figure A-7.

The load cells and load links were wired to provide a positive output voltage when the force exerted by the load cell on the subject was applied in the +x, +y or +z direction as shown in Figure A-7.

All transducers except the carriage accelerometers and the carriage velocity tachometer were referenced to the seat coordinate system. The carriage tachometer was wired to provide a positive output voltage during freefall. The carriage accelerometers were referenced to the carriage coordinate system, as shown in Figure A-7.

The ADAM manikin internal transducers were referenced to the manikin coordinate system which is shown in Figure A-8.

The manikin neck and lumbar load cells were wired to provide a positive output voltage when the force exerted by the load cell, on the neck or lumbar, was applied in the +x, +y or +z directions as shown in Figure A-8.

The manikin My torque transducers were wired to provide a positive output voltage when the torque experienced by the transducers was applied in the +y direction according to the right hand rule, as shown in Figure A-8.

Carriage velocity was measured using a Globe Industries tachometer Model 22A672-2. The rotor of the tachometer was attached to an aluminum wheel with a rubber "O" ring around its circumference to assure good rail contact. The wheel contacted the track rail and rotated as the carriage moved, producing an output voltage proportional to the velocity.

5.1 Accelerometers

This section describes the accelerometer instrumentation as required in the AAMRL/BBP test plan.

The chest accelerometer package consisted of three Endevco Model 7264-200 linear accelerometers mounted to a 1/2 x 1/2 x 1/2 inch aluminum block. An Endevco Model 7302A angular (Ry) accelerometer was mounted on a bracket adjacent to the triaxial chest block. The accelerometer packages were inserted into a steel protection shield to which a length of Velcro fastener strap was attached. The package was placed over the subject's sternum at the level of the xyphoid and was held there by fastening the Velcro strap around the subject's chest. A chest fiducial target was attached directly on top of the chest accelerometer package. Figure A-9 illustrates the chest accelerometer package attached to the "large" ADAM manikin.

Carriage accelerations were measured using three Endevco linear accelerometers: one model 2262A-200 for acceleration in the z direction and two models 2264-200 for accelerations in the x and y directions. The three accelerometers were mounted on a small acrylic block and located behind the seat on the VIP seat structure.

Seat accelerations were measured using three Endevco linear accelerometers: two Models 2264-150 for accelerations in the x and y directions and one model 2264-200 for acceleration in the z direction. The three linear accelerometers were attached to a 1 x 1 x 3/4 inch acrylic block and were mounted near the center of the load cell mounting plate.

Head accelerations for manikin tests were measured using three Endevco Model 2264-200 linear accelerometers and one Endevco Model 7302B angular (Ry) accelerometer. These accelerometers were internally mounted in the head of the manikins.

5.2 Load Transducers

This section describes the load transducer instrumentation as required in the AAMRL/BBP test plan.

The load transducer locations and dimensions are shown in Figures A-10a and A-10b.

Shoulder/anchor forces were measured using two GM-3D-SW and one AAMRL/DYN 3D-SW triaxial load cells, each capable of measuring forces in the x, y and z directions. The parameters measured are indicated below:

- Shoulder x, y and z force
- Left lap belt x, y and z force
- Right lap belt x, y and z force

The lap/vertical anchor force triaxial load cells were located on separate brackets mounted on the side of the seat frame parallel to the seat pan.

The shoulder strap force triaxial load cell was mounted on the seat frame between the seat back support plate and the headrest.

Left, right and center seat forces were measured using three load cells and three load links. The three load cells included two Strainsert Model FL2.5U-2SPKT and one FL2.5U-2.5SGKT load cells. The three load links, as shown in Figure A-11, were fabricated by DynCorp using Micro Measurement Model EA-06-062TJ-350 strain gages. All six measurement devices were located under the seat pan support plate. The load links were used for measuring loads in the x and y directions, two in the x direction and one in the y direction. Each load link housed a swivel ball which acted as a coupler between the seat pan and load cell mounting plate. The Strainsert load cells were used for measuring loads in the z direction. The seat pan instrumentation and the lap belt anchor load cells can be seen in Figure A-12.

Upper and lower headrest x forces were measured using two Strainsert Model FL1U-2SG load cells. The load cells were mounted on a rectangular mounting plate which was attached to the upper seat back. The headrest was attached directly to the load cells. The mounting plate/load cells/headrest was adjusted up or down depending on the location of the subjects head. The headrest and shoulder belt anchor load cells can be seen in Figure A-13.

For large ADAM manikin tests, Lumbar x, y and z forces and My torque, and Neck x, y and z forces and My torque were each measured using Denton Model 1914 and 1716 load cells respectively. These load cells were internally mounted in the manikins.

5.3 Calibration
Calibrations were performed before and after testing to confirm the accuracy and functional characteristics of the transducers. Pre-program and post-program calibrations are given in Tables A-3a through A-3e.

The calibration of all Strainsert load cells was performed by the Precision Measurement Equipment Laboratories (PMEL) at Wright-Patterson Air Force Base. PMEL calibrated these devices on a periodic basis and provided current sensitivity and linearity data.

The calibration of the accelerometers was performed by DynCorp using the comparison method (Ensor, 1970). A laboratory standard accelerometer, calibrated on a yearly basis by Endevco with standards traceable to the National Bureau of Standards, and a test accelerometer were mounted on a shaker table. The frequency response and phase shift of the test accelerometer were determined by driving the shaker table with a random noise generator and analyzing the outputs of the accelerometers with a Zenith 248/12 computer using Fourier analysis. The natural frequency and the damping factor of the test accelerometer were determined, recorded and compared to previous calibration data for that test accelerometer. Sensitivities were calculated at a 40 G/100 Hertz level. The sensitivity of the test accelerometer was determined by comparing its output to the output of the standard accelerometer.

The angular accelerometers were calibrated by DynCorp by comparing their output to the output of a linear standard accelerometer. The angular accelerometer is mounted parallel to the axis of rotation of a Honeywell low inertia D. C. motor. The standard accelerometer is mounted perpendicular to the axis of rotation at a radius of one inch to measure the tangential acceleration. The D. C. motor motion is driven at a constant sinusoidal angular acceleration of 100 Hertz and the sensitivity is calculated by comparing the rms output voltages of the angular and linear accelerometers.

The shoulder/lap triaxial load cells and load links were calibrated by DynCorp. These transducers were calibrated to a laboratory standard load cell in a special test fixture. The sensitivity and linearity of each test load cell were obtained by comparing the output of the test load cell to the output of the laboratory standard under identical loading conditions. The laboratory standard load cell, in turn, is calibrated by PMEL on a periodic basis.

The velocity wheel is calibrated periodically by DynCorp by rotating the wheel at approximately 2000, 4000 and 6000 revolutions per minute (RPM) and recording both the output voltage and the RPM.

6. DATA ACQUISITION

Data acquisition was controlled by a comparator on the Master Instrumentation Control Unit in the Instrumentation Station. The test was initiated when the comparator countdown clock reached zero. The comparator was set to start data collection at a preselected time.

A reference mark pulse was generated to mark the ADACS electronic data at a preselected time after test initiation to place the reference mark close to the impact point. At the same time, the reference mark pulse triggered a strobe light to mark the test photogrammetric data. The reference mark time was used as the start time for data processing of the electronic and photogrammetric data.

Prior to each test and prior to placing the subject in the seat, data were recorded to establish a zero reference for all data transducers. These data were stored separately from the test data and were used in the processing of data.

6.1 Automatic Data Acquisition and Control System (ADACS)

Installation of the ADACS instrumentation is shown in Figure A-14. The three major components of the ADACS system are the power conditioner, signal conditioners and the encoder. A block diagram of the ADACS is shown in Figure A-15. The signal conditioners contain forty-eight amplifiers with programmable gain and filtering.

Bridge excitation for load cells and accelerometers was 10 VDC. Bridge completion and balance resistors were added as required to each module input connector.

The forty-eight module output data signals were digitized and encoded into forty-eight 11-bit digital words. Two additional 11-bit synchronization (sync) words were added to the data frame making a fifty word capability.

Three synchronization pulse trains (bit sync, word sync and frame sync) along with the NRZL data were sent to the computer via a junction box data cable.

The PDP 11/34 minicomputer received serial data from the ADACS. The serial data coming from the carriage are converted to parallel data in the data formatter. The data formatter inputs data by direct memory access (DMA) into the computer memory via a buffered data channel where data are temporarily stored on disk. Data are later transferred to the VAX 11/750 and output to magnetic tape for permanent storage. The interrelationships among the data acquisition and storage equipment are shown in Figure A-16.

Test data could be reviewed immediately after each test by using the "quick look" SCAN routine. SCAN was used to produce a plot of the data stored on any channel as a function of time. The routine determined the minimum and maximum values of any data plot. It was also used to calculate the rise time, pulse duration and carriage acceleration and create a disk file containing significant test parameters.

6.2 Photogrammetric Data Acquisition

Two onboard high-speed LOCAM cameras, operating at 500 frames per second, were used to produce the photogrammetric data. The side camera was a LOCAM Model 50-0002 (S/N 387) and the oblique camera was a LOCAM Model 50-0002 (S/N 374). The side and oblique cameras each used a 9 mm lens (S/N 72019 and 69519 respectively).

Motion of the subjects' helmet, cheek, shoulder and chest were quantified by tracking the motion of subject-mounted fiducials. Reference fiducials were placed on the test fixture. The fiducial used was a .75" diameter black circle on a 1.25" diameter white target. The locations of the fiducials generally followed the guidelines provided in "Film Analysis Guides for Dynamic Studies of Test Subjects, Recommended Practice" (SAE J138, March 1980). Figures A-17 and A-18 identify the fiducial target locations.

All cameras were automatically started at a preset time in the test sequence by a signal from the camera and lighting control station.

The photogrammetric data were time correlated in each test. Immediately prior to impact, a reference mark signal triggered the flash unit to mark the camera film frame. At that time, a 100 PPS signal activated the camera light emitting diode (LED) driver which activated the camera LED, producing a time mark at the film edge. This reference mark was then used to correlate the photogrammetric data with the electronically measured data.

The photogrammetric data will be processed as required on the Automatic Film Reader (AFR) system, shown in the block diagram in Figure A-19. The fiducial tracking routine is initiated via the Data General terminal. The tracking routine is booted from a floppy disk into the Nova 3/12 memory. The system is capable of tracking fiducials manually or automatically. The Nova 3/12 outputs an x-y film coordinate position to magnetic tape for each fiducial being tracked. Data are transferred from magnetic tape to the DEC PDP 11/34 disk file and then transferred to the DEC VAX 11/750 disk file for processing.

An Instant Analytical Replay (INSTAR) video system was also used to provide coverage of each test. This video recorder and display unit is capable of recording high-speed motion at a rate of 120 frames per second. Immediate replay of the impact is possible in real time or in slow motion.

7. PROCESSING PROGRAMS

The executable images for the ADACS processing programs are located in directory PROCESS of the VAX 11/750 and the test data is assumed to be stored in logical directory DATADIR. All plots and the test summary sheet are output to the LNØ3 laser printer. The test base file is output to directory PROCESS.

7.1 ADACS Program Operation

The two Fortran programs that process the ADACS test data for the DP1 Study (Vertical Deceleration Tower facility) are named DP1VDTØA and DP1VDTØB. The DCL file which controls the execution of these programs is named DP1VDT. The character string 'DP1' identifies the study, 'VDT' identifies the facility (Vertical Deceleration Tower), 'Ø' is the revision number and the last character determines the program order of execution.

DP1VDTØA accepts user input and creates a temporary DCL file which controls the sequential batch processing of a specified number of tests. DP1VDTØA requests the user to enter the total number of tests to be processed and the test number of each test. Logical directory DATADIR is assumed to contain a zero reference file named '<test no>Z.VDT', a test data file named '<test no>D.VDT' and a sensitivity file named '<test no>S.VDT'.

The default test parameters are retrieved from the header block of the test data file and displayed as a menu on the screen. The user may specify new values for any of the displayed test parameters. The test parameters include the subject ID, weight, age, height and sitting height. Additional parameters include the cell type, nominal G level, subject type (manikin or human) and belt preload status (computed or not computed). If the belt preloads were computed, then the shoulder and lap preloads are also displayed.

DP1VDT0B generates time histories for the carriage and seat x, y, and z axis linear accelerations, the seat z axis DRI, and the carriage velocity. Time histories for the head and chest linear and angular accelerations and the resultant linear accelerations are computed. Other quantities include the shoulder, left and right lap x, y and z axis forces, headrest forces, and x, y and z axis seat forces. Resultants are computed for the shoulder, left lap, right lap and seat. The seat z force is corrected to subtract out the force due to the mass of the seat pan. If the ADAM manikin is used, time histories are also generated for the ADAM neck and lumbar x, y and z axis and resultant forces, and the y axis torques.

The impact rise time, duration and velocity change are computed and stored in the test base file. Values for the preimpact level and the extrema for each time history are stored in the test base file and printed out as a summary sheet for each test. The time histories are also plotted.

DP1VDT0B searches for the maximum head x acceleration for 100 ms after the start of impact to avoid head strike spikes that occur later in the 600 ms window. DP1VDT0B searches for two different peaks of the carriage z acceleration. The second peak is found by searching the time window backward until the acceleration exceeds 4.0 G. This is used as the starting point of the search, and the search is ended when the acceleration falls below 3.5 G. The first peak is found by searching backward from this point.

7.2 ADACS Program Flowcharts

Flowcharts of the two programs, DP1VDT0A and DP1VDT0B are shown in Figures A-20 and A-21 respectively. Each flowchart identifies the files used and the subroutines called by the program. Some of the subroutines which are not flowcharted are located in user libraries. Others have such a simple structure that they do not require flowcharting.

DIGITAL INSTRUMENTATION REQUIREMENTS

PROGRAM A PARAMETRIC STUDY USING THE DYNAMIC PRELOAD DEVICE - PHASE I (DPI)   DATE 05 MAR 90   THRU 21 MAR 90

FACILITY VERTICAL DECELERATION TOWER   RUN 1775   THRU 1810

DYNCORP

DATA CHANNEL	DATA POINT	XDUCER MFG & TYPE	SERIAL NUMBER	XDUCER SENS	EXCITE V	CHAN	FILTER SERIES	FILTER S/C	AMP GAIN	AMP S/N	SAMPLE RATE	SAMPLE FORMAT	FULL SCALE SENS.	FILTER HZ	XDUCER ZERO	RANGE	BRIDGE BALANCE RESISTORS	BRIDGE COMP RESISTORS	SPECIAL NOTATIONS
1	CARRIAGE z ACCEL.	ENDEVCO 2262A-200	FR42	4.154 mv/G	10.00	1	60	1	10	13	1K	1	60.2G	120	2.5	+5.0 0.0	106K +IN GND	-	
2	CARRIAGE x ACCEL.	ENDEVCO 2264-200	EP10	2.481 mv/G	10.00	2	60	2	25	5	1K	1	40.3G	120	2.5	+5.0 0.0	-	1.6K	
3	CARRIAGE y ACCEL.	ENDEVCO 2264-200	BW10	2.567 mv/G	10.00	3	60	3	25	1	1K	1	39.0G	120	2.5	+5.0 0.0	-	1.6K	
4	HEAD x ACCEL.	ENDEVCO 2264-200	CH74	2.952 mv/G	10.00	4	60	4	25	36	1K	1	33.9G	120	2.5	+5.0 0.0	-	1.6K	
5	HEAD y ACCEL.	ENDEVCO 2264-200	BQ42	2.718 mv/G	10.00	5	60	5	25	28	1K	1	36.8G	120	2.5	+5.0 0.0	162K +IN GND	1.5K	
6	HEAD z ACCEL.	ENDEVCO 2264-200	CH70	2.680 mv/G	10.00	6	60	6	10	5	1K	1	93.3G	120	2.5	+5.0 0.0	-	1.6K	
7	HEAD Ry ANG. ACCEL.	ENDEVCO 7302B	TJ75	3.78 uv/RAD/SEC2	10.00	7	60	7	100	14	1K	1	6614 RAD/SEC2	120	2.5	+5.0 0.0	-	-	
8	CHEST x	ENDEVCO 7264-200	BH76H	3.183 mv/G	10.00	8	60	8	25	24	1K	1	31.4G	120	2.5	+5.0 0.0	76K +IN GND	1.5K	
9	CHEST y	ENDEVCO 7264-200	BH81H	3.252 mv/G	10.00	9	60	9	50	18	1K	1	15.4G	120	2.5	+5.0 0.0	-	1.5K	
10	CHEST z	ENDEVCO 7264-200	BH87H	2.982 mv/G	10.00	10	60	10	10	24	1K	1	83.8G	120	2.5	+5.0 0.0	100K +IN GND	1.5K	
11	CHEST Ry ANG. ACCEL.	ENDEVCO 7302A	AB15	6.68 uv/RAD/SEC2	10.00	11	60	11	100	27	1K	1	3743 RAD/SEC2	120	2.5	+5.0 0.0	-	-	
12	LEFT SEAT z FORCE	STRAINSERT FL2.5U-2SGKT	7588-3	8.00 uv/LB	10.00	12	60	12	100	6	1K	1	3125 LB	120	2.5	+5.0 0.0	-	-	
13	RIGHT SEAT z FORCE	STRAINSERT FL2.5U-2SPKT	3294-1	8.03 uv/LB	10.00	13	60	13	100	22	1K	1	3113 LB	120	2.5	+5.0 0.0	-	-	
14	CENTER SEAT z FORCE	STRAINSERT FL2.5U-2SPKT	3294-2	8.00 uv/LB	10.00	14	60	14	50	10	1K	1	6250 LB	120	2.5	+5.0 0.0	-	-	

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TABLE A-1a: INSTRUMENTATION REQUIREMENTS

DYNCORP

DIGITAL INSTRUMENTATION REQUIREMENTS

PROGRAM A PARAMETRIC STUDY USING THE DYNAMIC PRELOAD DEVICE - PHASE I (DP1) **DATE** 05 MAR 90 **THRU** 21 MAR 90

FACILITY VERTICAL DECELERATION TOWER **RUN** 1775 **THRU** 1810

DATA CHANNEL	DATA POINT	XDUCER MFG & TYPE	SERIAL NUMBER	XDUCER SENS	EXCITE V	CHAN	FILTER SERIES	FILTER S/N	AMP GAIN	AMP S/N	SAMPLE RATE	SAMPLE FORMAT	FULL SCALE SENS.	FILTER HZ	XDUCER ZERO	RANGE	BRIDGE BALANCE RESISTORS	BRIDGE COMP RESISTORS	SPECIAL NOTATIONS
15	LEFT SEAT x FORCE	MM/DYN EA-06-062TJ-350	2	10.46 uv/LB	10.00	15	60	15	201	11	1K	1	1138 LB	120	2.5	+5.0 0.0	-	-	
16	RIGHT SEAT x FORCE	MM/DYN EA-06-062TJ-350	3	10.86 uv/LB	10.00	16	60	16	201	5	1K	1	1145 LB	120	2.5	+5.0 0.0	26K -IN GND	-	
17	CENTER SEAT x FORCE	MM/DYN EA-06-062TJ-350	5	10.00 uv/LB	10.00	17	60	17	201	17	1K	1	1244 LB	120	2.5	+5.0 0.0	-	-	
18	LEFT LAP x LOAD	GM 3D-SW	20X	4.92 uv/LB	10.00	18	60	18	201	4	1K	1	2528 LB	120	2.5	+5.0 0.0	43K +IN GND	-	
19	LEFT LAP y LOAD	GM 3D-SW	20Y	5.32 uv/LB	10.00	19	60	19	402	12	1K	1	1169 LB	120	2.5	+5.0 0.0	76K -IN GND	-	
20	LEFT LAP z LOAD	GM 3D-SW	20Z	6.33 uv/LB	10.00	20	60	20	201	15	1K	1	1965 LB	120	2.5	+5.0 0.0	33K +IN GND	-	
21	RIGHT LAP x LOAD	AAMRL/DYN 3D-SW	23X	6.89 uv/LB	10.00	21	60	21	201	8	1K	1	1805 LB	120	2.5	+5.0 0.0	19K +IN GND	-	
22	RIGHT LAP y LOAD	AAMRL/DYN 3D-SW	23Y	7.16 uv/LB	10.00	22	60	22	402	8	1K	1	869 LB	120	2.5	+5.0 0.0	130K -IN GND	-	
23	RIGHT LAP z LOAD	AAMRL/DYN 3D-SW	23Z	7.92 uv/LB	10.00	23	60	24	201	3	1K	1	1570 LB	120	2.5	+5.0 0.0	-	-	
24	VELOCITY	GLOBE 22A672-2	4	.0612 V/F/S	-	24	30	1	1	-	1K	1	81.7 F/S	60	0	+5.0 0.0	-	-	SIGNAL ATTENUATED BY 7.65 SENSITIVITY=.468V/F/S÷7.65=.0612 V/F/S
25	SHOULDER x LOAD	GM 3D-SW	21Z	6.08 uv/LB	10.00	25	60	25	402	6	1K	1	1023 LB	120	2.5	+5.0 0.0	23K +IN GND	-	
26	SHOULDER y LOAD	GM 3D-SW	21Y	4.86 uv/LB	10.00	26	60	26	800	5	1K	1	643 LB	120	2.5	+5.0 0.0	18K -IN GND	-	
27	SHOULDER z LOAD	GM 3D-SW	21X	5.11 uv/LB	10.00	27	60	27	402	9	1K	1	1217 LB	120	2.5	+5.0 0.0	23K -IN GND	-	
28	SEAT x ACCEL.	ENDEVCO 2264-150	BB13	2.450 mv/G	10.00	28	60	28	50	2	1K	1	20.4G	120	2.5	+5.0 0.0	-	1.65K	

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TABLE A-1b: INSTRUMENTATION REQUIREMENTS

DIGITAL INSTRUMENTATION REQUIREMENTS

DYNCORP

PROGRAM A PARAMETRIC STUDY USING THE DYNAMIC PRELOAD DEVICE - PHASE I (DP1) **DATE** 05 MAR 90 **THRU** 21 MAR 90

FACILITY VERTICAL DECELERATION TOWER **RUN** 1175 **THRU** 1810

DATA CHANNEL	DATA POINT	XDUCER MFG & TYPE	SERIAL NUMBER	XDUCER SENS	EXCITE V	EXCITE CHAN	FILTER SERIES	FILTER S/N	AMP GAIN	AMP S/N	SAMPLE RATE	SAMPLE FORMAT	FULL SCALE SENS.	FILTER HZ	XDUCER ZERO	XDUCER RANGE	BRIDGE BALANCE RESISTORS	BRIDGE COMP RESISTORS	SPECIAL NOTATIONS
29	SEAT y ACCEL.	ENDEVCO 2264-150	2A2G	2.741 mv/G	10.00	29	60	29	50	22	1K	1	18.2G	120	2.5	+5.0 0.0	-	1.65K	
30	SEAT z ACCEL.	ENDEVCO 2264-200	BX17	2.730 mv/G	10.00	30	60	30	25	20	1K	1	36.6G	120	2.5	+5.0 0.0	153K +IN GND	1.47K	
31	LARGE ADAM NECK My	DENTON 1716	114	6.36 uv/LB-IN	10.00	31	60	38	50	35	1K	1	7862 LB-IN	120	2.5	+5.0 0.0	-	-	
32	UPPER HEADREST x FORCE	STRAINSERT FL1U-2SG	0207	20.29 uv/LB	10.00	32	60	32	201	1	1K	1	613 LB	120	2.5	+5.0 0.0	-	-	
33	LOWER HEADREST x FORCE	STRAINSERT FL1U-2SG	0218	20.00 uv/LB	10.00	33	60	33	201	12	1K	1	622 LB	120	2.5	+5.0 0.0	-	-	
34	LARGE ADAM NECK x FORCE	DENTON 1716	114	8.07 uv/LB	10.00	34	60	34	100	34	1K	1	3098 LB	120	2.5	+5.0 0.0	-	-	
35	LARGE ADAM NECK y FORCE	DENTON 1716	114	7.70 uv/LB	10.00	35	60	35	201	6	1K	1	1615 LB	120	2.5	+5.0 0.0	-	-	
36	LARGE ADAM NECK z FORCE	DENTON 1716	114	4.30 uv/LB	10.00	36	60	36	201	9	1K	1	2893 LB	120	2.5	+5.0 0.0	-	-	
37	EVENT REFERENCE	-	-	1.0 VOLT	-	37	1000	3	2.5	19	1K	1	2.5 VOLT	2000	5.0	+5.0 0.0	-	-	
38	T-Ø PULSE	-	-	1.0 VOLT	-	38	1000	12	1	-	1K	1	5.0 VOLT	2000	5.0	+5.0 0.0	-	-	
39	L. ADAM LUMBAR x FORCE	DENTON 1914	041	6.30 uv/LB	10.00	39	60	39	50	1	1K	1	7937 LB	120	2.5	+5.0 0.0	-	-	
40	L. ADAM LUMBAR y FORCE	DENTON 1914	041	6.32 uv/LB	10.00	40	60	40	100	17	1K	1	3956 LB	120	2.5	+5.0 0.0	-	-	
41	L. ADAM LUMBAR z FORCE	DENTON 1914	041	2.692 uv/LB	10.00	41	60	41	100	33	1K	1	9287 LB	120	2.5	+5.0 0.0	-	-	
42	L. ADAM LUMBAR My TORQUE	DENTON 1914	041	5.04 uv/LB-IN	10.00	42	60	42	25	10	1K	1	19841 LB-IN	120	2.5	+5.0 0.0	-	-	

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TABLE A-1c: INSTRUMENTATION REQUIREMENTS

DIGITAL INSTRUMENTATION REQUIREMENTS

DYNCORP

PROGRAM A PARAMETRIC STUDY USING THE DYNAMIC PRELOAD DEVICE - PHASE I (DP1) DATE 05 MAR 90 THRU 21 MAR 90

FACILITY VERTICAL DECELERATION TOWER RUN 1775 THRU 1810

DATA CHANNEL	DATA POINT	XDUCER MFG & TYPE	SERIAL NUMBER	XDUCER SENS	EXCITE V	EXCITE CHAN	FILTER SERIES	FILTER S/N	AMP GAIN	AMP S/N	SAMPLE RATE	SAMPLE FORMAT	FULL SCALE SENS.	FILTER HZ	XDUCER ZERO	XDUCER RANGE	BRIDGE BALANCE RESISTORS	BRIDGE COMP RESISTORS	SPECIAL NOTATIONS
47	BIAS VOLTAGE	-	-	1.0 VOLT	-	47	180	3	1	-	1K	1	2.5 VOLT	360	0.0	+5.0 0.0	-	-	
48	10 VOLT EXCITATION	-	-	1.0 VOLT	10.00	48	180	8	1	-	1K	1	2.5 VOLT	360	0.0	+5.0 0.0	-	-	

PAGE 4 OF 4

TABLE A-1d: INSTRUMENTATION REQUIREMENTS

MANUFACTURER	MODEL	RANGE	SENSITIVITY (mv)	RESONANCE FREQ (Hz)	FREQUENCY RESPONSE (Hz.)	EXCITATION (Volt)	2 ARM or 4 ARM	ADDITIONAL NOTES
Endevco	2264-150	± 150 G	2.5/G	3400	0-800	10	2 arm	Linear accelerometer
Endevco	2264-200	± 200 G	2.5/G	4700	0-1200	10	2 arm	Linear accelerometer
Endevco	7264-200	± 200 G	2.5/G	6000	0-1200	10	2 arm	Linear accelerometer, 1000 G overrange
Endevco	2262A-200	± 200 G	2.5/G	7000	0-2000	10	4 arm	Linear accelerometer, .7 damping ratio
Endevco	7302A	± 50,000 Rad/Sec^2	.0055 /Rad/Sec^2	2500	1-600	10	4 arm	Angular accelerometer, X10 overrange
Endevco	7302B	± 50,000 Rad/Sec^2	.004 /Rad/Sec^2	3000	1-600	10	4 arm	Angular accelerometer, X10 overrange
Strainsert	FL2.5U-2SPKT & 2SGKT	± 2500 LB	.008/LB	3600	0-2000	10	4 arm	Load cell; 15 V max exc.; 5 K LB max. overrange
Strainsert	FL1U-2SG	± 1000 LB	.020/LB	3600	0-2000	10	4 arm	Load cell; 15 V max exc.; 2 K LB max. overrange
Denton	1914	± 5000 LB	-	N/A	N/A	10	4 arm	6 axis load cell; 15 V max. exc.
Denton	1716	± 3000 LB	-	N/A	N/A	10	4 arm	6 axis load cell; 15 V max. exc.

TABLE A-2: TYPICAL TRANSDUCER SPECIFICATIONS

DYNCORP PROGRAM CALIBRATION LOG

PROGRAM A PARAMETRIC STUDY USING THE DYNAMIC PRELOAD DEVICE - PHASE I (DP1) **DATES:** 05 MAR 90 - 21 MAR 90

FACILITY VERTICAL DECELERATION TOWER **RUN NUMBERS:** 1775 - 1810

DATA POINT	TRANSDUCER MFG.& MODEL	SERIAL NUMBER	PRE-CAL		POST-CAL		%CHANGE	NOTES
			DATE	SENS	DATE	SENS		
CARRIAGE z ACCEL.	ENDEVCO 2262A-200	FR42	27FEB90	4.154 mv/G	27MAR90	4.154 mv/G	0	
CARRIAGE x ACCEL.	ENDEVCO 2264-200	BP10	27FEB90	2.481 mv/G	27MAR90	2.482 mv/G	0	
CARRIAGE y ACCEL.	ENDEVCO 2264-200	BW10	27FEB90	2.567 mv/G	27MAR90	2.585 mv/G	+.7	
HEAD x ACCEL.	ENDEVCO 2264-200	CH74	26FEB90	2.952 mv/G	27MAR90	2.943 mv/G	-.3	
HEAD y ACCEL.	ENDEVCO 2264-200	BQ42	26FEB90	2.718 mv/G	27MAR90	2.711 mv/G	-.3	
HEAD z ACCEL.	ENDEVCO 2264-200	CH70	26FEB90	2.680 mv/G	27MAR90	2.674 mv/G	-.2	
HEAD Ry ANG. ACCEL.	ENDEVCO 7302B	TJ75	23FEB90	3.78 uv/RAD/SEC2	27MAR90	3.787 uv/RAD/SEC2	+.2	
CHEST x ACCEL.	ENDEVCO 7264-200	BH76H	27FEB90	3.183 mv/G	27MAR90	3.185 mv/G	+.1	
CHEST y ACCEL.	ENDEVCO 7264-200	BH81H	27FEB90	3.252 mv/G	27MAR90	3.252 mv/G	0	
CHEST z ACCEL.	ENDEVCO 7264-200	BH87H	27FEB90	2.982 mv/G	27MAR90	2.943 mv/G	-1.3	

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TABLE A-3a: TRANSDUCER PRE- AND POST-CALIBRATION

DYNCORP PROGRAM CALIBRATION LOG

PROGRAM A PARAMETRIC STUDY USING THE DYNAMIC PRELOAD DEVICE - PHASE I (DP1) **DATES:** 05 MAR 90 - 21 MAR 90

FACILITY VERTICAL DECELERATION TOWER **RUN NUMBERS:** 1775 - 1810

DATA POINT	TRANSDUCER MFG.& MODEL	SERIAL NUMBER	PRE-CAL		POST-CAL		%CHANGE	NOTES
			DATE	SENS	DATE	SENS		
CHEST Ry ANG. ACCEL.	ENDEVCO 7302A	AB15	23FEB90	6.68 uv/RAD/SEC2	27MAR90	6.68 uv/RAD/SEC2	0	
LEFT SEAT x FORCE	MM/DYN EA-06-062TJ-350	2	26FEB90	10.46 uv/LB	29MAR90	10.50 uv/RAD/SEC2	+.4	
RIGHT SEAT x FORCE	MM/DYN EA-06-062TJ-350	3	26FEB90	10.86 uv/LB	29MAR90	10.88 uv/RAD/SEC2	+.2	
CENTER SEAT y FORCE	MM/DYN EA-06-062TJ-350	5	26FEB90	10.00 uv/LB	29MAR90	10.11 uv/RAD/SEC2	+1.1	
LEFT LAP x LOAD	GM 3D-SW	20X	23FEB90	4.92 uv/LB	30MAR90	4.95 uv/LB	+.6	
LEFT LAP y LOAD	GM 3D-SW	20Y	23FEB90	5.32 uv/LB	30MAR90	5.38 uv/LB	+1.1	
LEFT LAP z LOAD	GM 3D-SW	20Z	23FEB90	6.33 uv/LB	30MAR90	6.31 uv/LB	-.3	
RIGHT LAP x LOAD	AAMRL/DYN 3D-SW	23X	23FEB90	6.89 uv/LB	30MAR90	6.93 uv/LB	+.6	
RIGHT LAP y LOAD	AAMRL/DYN 3D-SW	23Y	23FEB90	7.16 uv/LB	30MAR90	7.22 UV/LB	+.8	
RIGHT LAP z LOAD	AAMRL/DYN 3D-SW	23Z	23FEB90	7.92 uv/LB	30MAR90	7.92 uv/LB	0	

PAGE 2 OF 5

TABLE A-3b: TRANSDUCER PRE- AND POST-CALIBRATION

DYNCORP PROGRAM CALIBRATION LOG

PROGRAM A PARAMETRIC STUDY USING THE DYNAMIC PRELOAD DEVICE - PHASE I (DP1) **DATES:** 05 MAR 90 - 21 MAR 90

FACILITY VERTICAL DECELERATION TOWER **RUN NUMBERS:** 1775 - 1810

DATA POINT	TRANSDUCER MFG.& MODEL	SERIAL NUMBER	PRE-CAL		POST-CAL		%CHANGE	NOTES
			DATE	SENS	DATE	SENS		
SHOULDER x LOAD	GM 3D-SW	21Z	23FEB90	6.08 uv/LB	30MAR90	6.14 uv/LB	+1.0	
SHOULDER y LOAD	GM 3D-SW	21Y	23FEB90	4.86 uv/LB	30MAR90	4 94 uv/LB	+1.6	
SHOULDER z LOAD	GM 3D-SW	21X	23FEB90	5.11 uv/LB	30MAR90	5.16 uv/LB	+1.0	
VELOCITY	GLOBE 22A672-2	4	27JUL89	.0612 V/F/S	-	-	-	CALIBRATED PERIODICALLY BY DYNCORP PERSONNEL
SEAT x ACCEL.	ENDEVCO 2264-150	BB13	27FEB90	2.450 mv/G	28MAR90	2.445 mv/G	-.2	
SEAT y ACCEL.	ENDEVCO 2264-150	2A20	27FEB90	2.741 mv/G	28MAR90	2.757 mv/G	+.6	
SEAT z ACCEL.	2264-200	BX17	27FEB90	2.730 mv/G	28MAR90	2.735 mv/G	+.2	

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TABLE A-3c: TRANSDUCER PRE- AND POST-CALIBRATION

DYNCORP PROGRAM CALIBRATION LOG

PROGRAM A PARAMETRIC STUDY USING THE DYNAMIC PRELOAD DEVICE - PHASE I (DPI) **DATES:** 05 MAR 90 - 21 MAR 90

FACILITY VERTICAL DECELERATION TOWER **RUN NUMBERS:** 1775 - 1810

DATA POINT	TRANSDUCER MFG.& MODEL	SERIAL NUMBER	PRE-CAL		POST-CAL		XCHANGE	NOTES
			DATE	SENS	DATE	SENS		
LEFT SEAT z FORCE	STRAINSERT FL2.5U-2SGKT	7588-3	17MAY89	8.00 uv/LB	-	-	-	
RIGHT SEAT z FORCE	STRAINSERT FL2.5U-2SPKT	3294-1	24AUG89	8.03 uv/LB	-	-	-	
CENTER SEAT z FORCE	STRAINSERT FL2.5U-2SPKT	3294-2	24AUG89	8.00 uv/LB	-	-	-	
UPPER HEADREST x FORCE	STRAINSERT FL1U-2SG	0207	05JAN89	20.29 uv/LB	-	-	-	
LOWER HEADREST x FORCE	STRAINSERT FL1U-2SG	0218	09NOV88	20.00 uv/LB	-	-	-	

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TABLE A-3d: TRANSDUCER PRE- AND POST-CALIBRATION

DYNCORP PROGRAM CALIBRATION LOG

PROGRAM A PARAMETRIC STUDY USING THE DYNAMIC PRELOAD DEVICE - PHASE I (DP1) **DATES:** 05 MAR 90 - 21 MAR 90

FACILITY VERTICAL DECELERATION TOWER **RUN NUMBERS:** 1775 - 1810

DATA POINT	TRANSDUCER MFG.& MODEL	SERIAL NUMBER	PRE-CAL		POST-CAL		%CHANGE	NOTES
			DATE	SENS	DATE	SENS		
LARGE ADAM NECK My	DENTON 1716	114	06MAR90	6.36 uv/LB-IN				ALL LARGE ADAM TRANSDUCERS ON THIS PAGE ARE SRL'S RESPONSIBILITY. NO POST-CALS WERE SUBMITTED.
LARGE ADAM NECK x FORCE	DENTON 1716	114	06MAR90	8.07 uv/LB				
LARGE ADAM NECK y FORCE	DENTON 1716	114	06MAR90	7.70 uv/LB				
LARGE ADAM NECK z FORCE	DENTON 1716	114	06MAR90	4.30 uv/LB				
LARGE ADAM LUMBAR x FORCE	DENTON 1914	041	03MAR90	6.30 uv/LB				
LARGE ADAM LUMBAR y FORCE	DENTON 1914	041	03MAR90	6.32 uv/LB				
LARGE ADAM LUMBAR z FORCE	DENTON 1914	041	03MAR90	2.692 uv/LB				
LARGE ADAM LUMBAR My FORCE	DENTON 1914	041	03MAR90	5.04 uv/LB-IN				

PAGE 5 OF 5

TABLE A-3e: TRANSDUCER PRE- AND POST-CALIBRATION

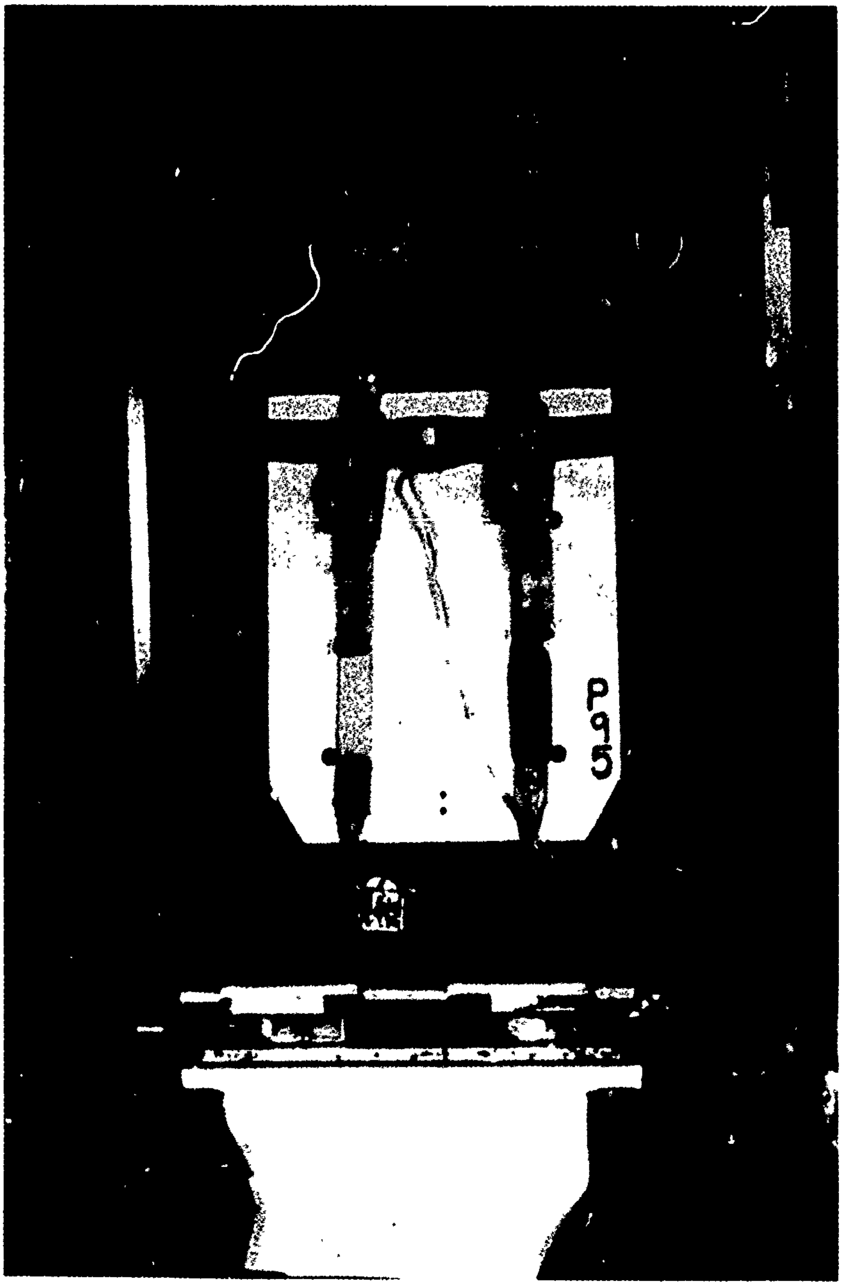


FIGURE A-1: VIP SEAT FIXTURE

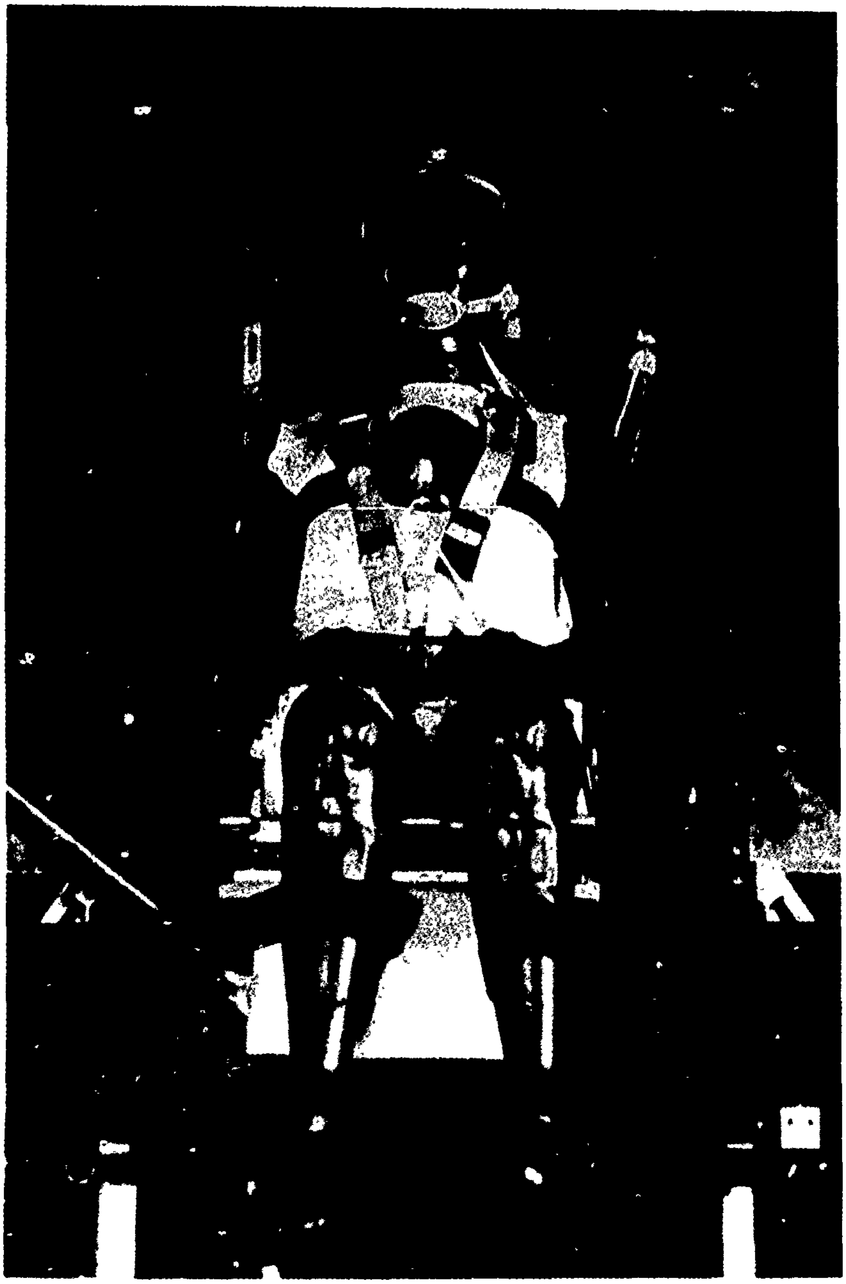


FIGURE A-2: SUBJECT LEG AND THIGH RESTRAINTS

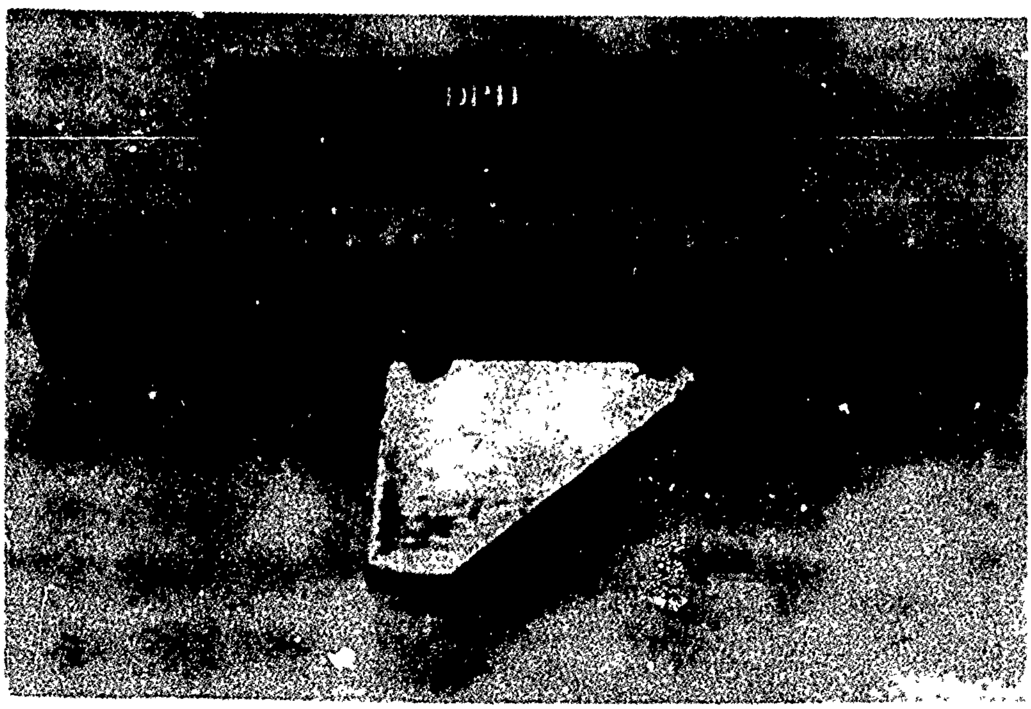


FIGURE A-3: DYNAMIC PRELOAD DEVICE BLADE

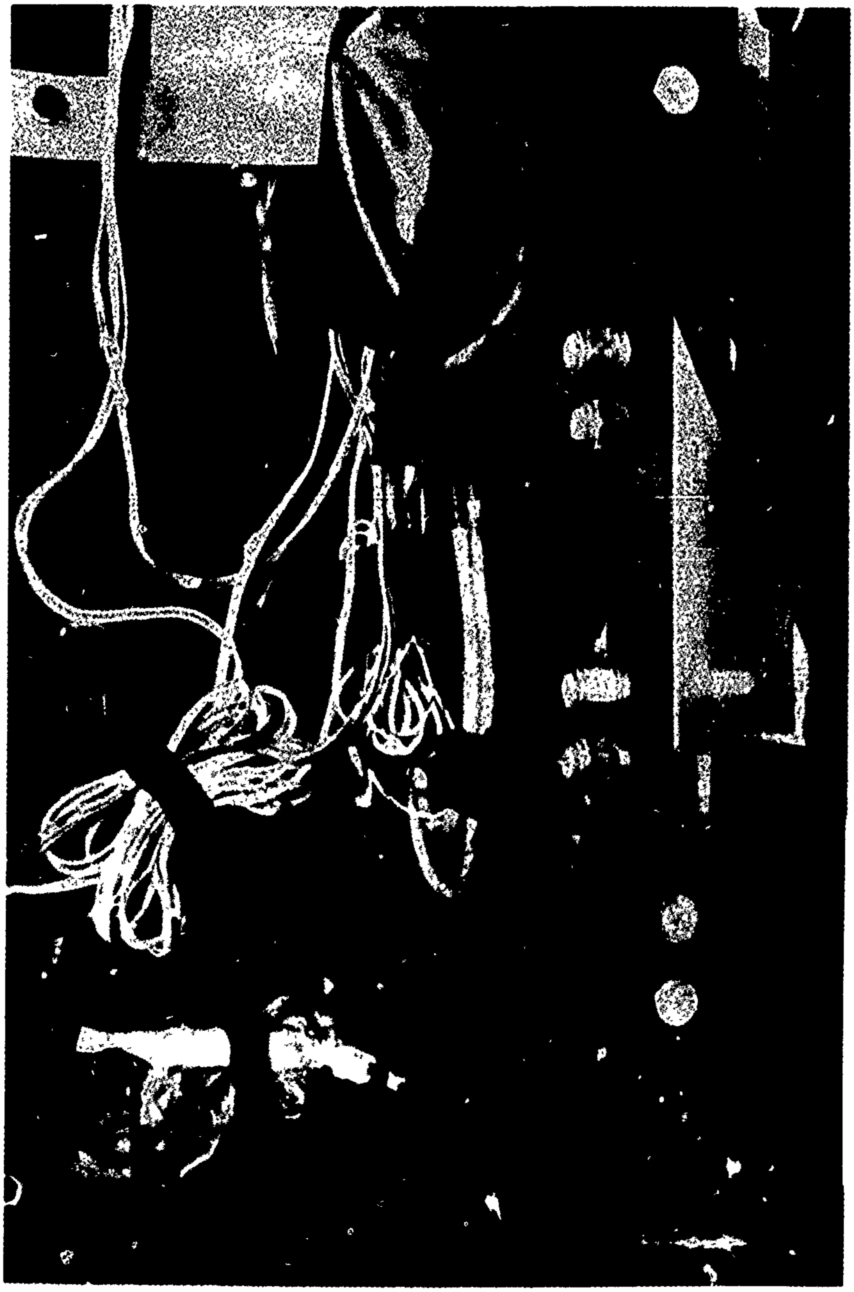


FIGURE A-4: DYNAMIC PRELOAD DEVICE BLADE

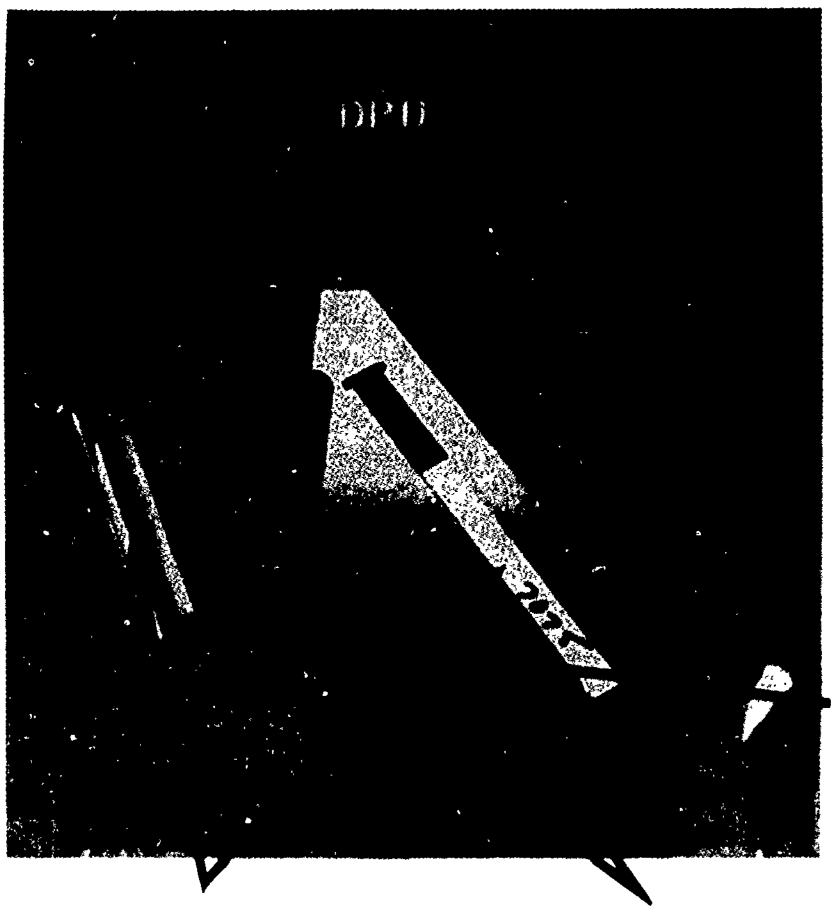


FIGURE A-5: SHEAR SAMPLE AND SHEAR SAMPLE HOLDER

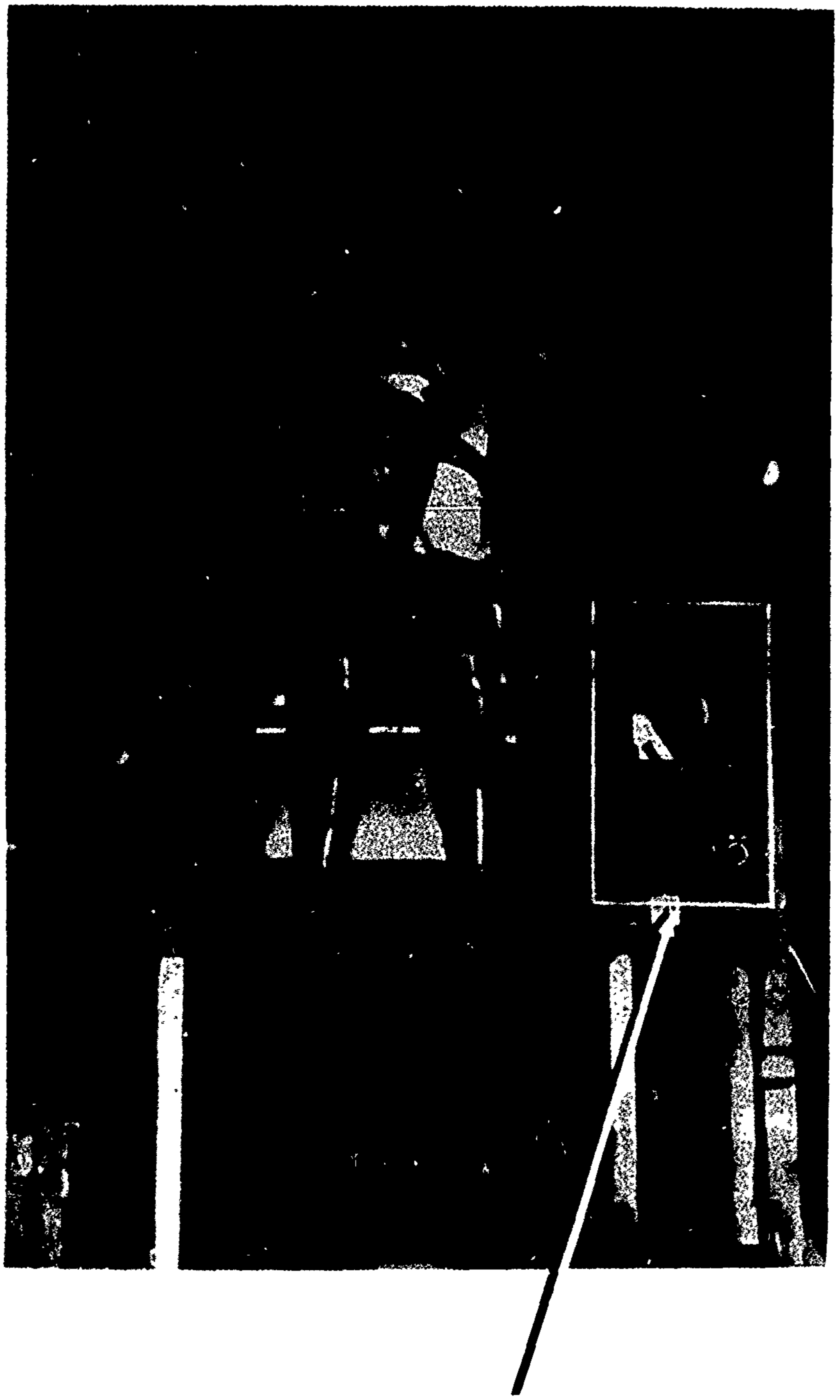
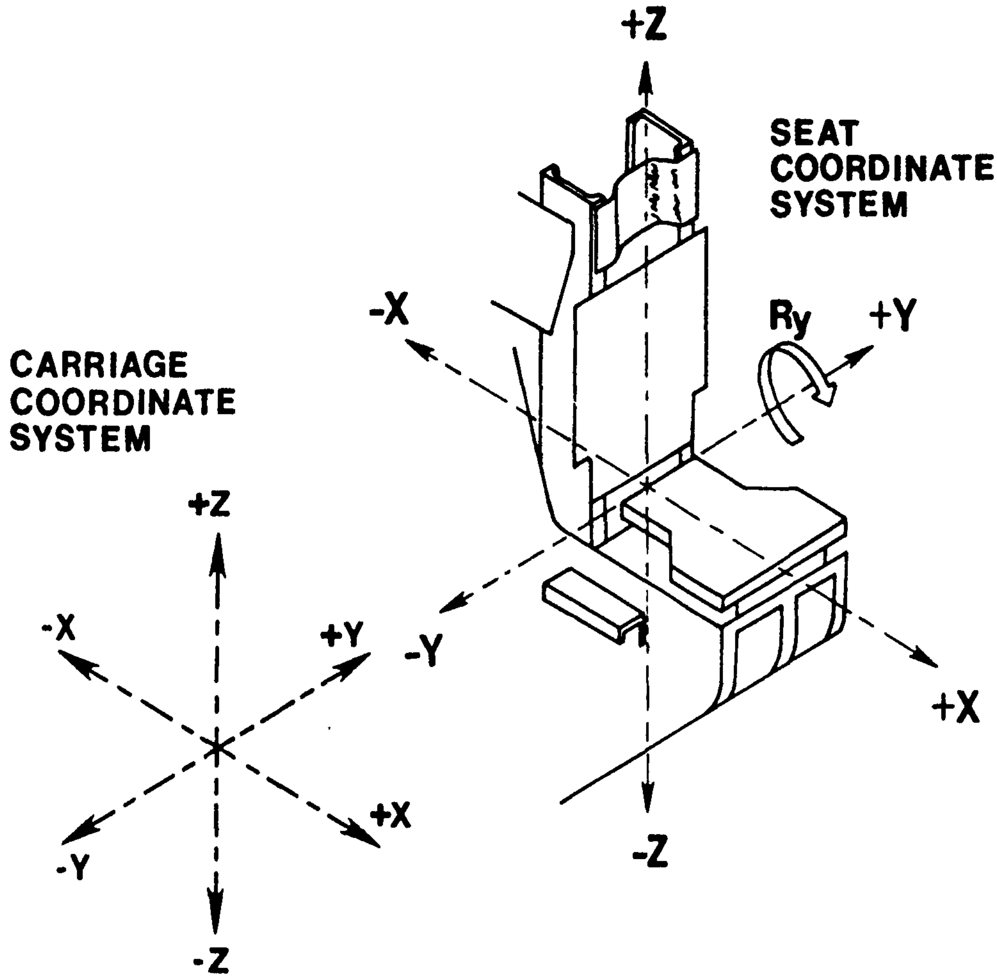


FIGURE A-6: DYNAMIC PRELOAD DEVICE



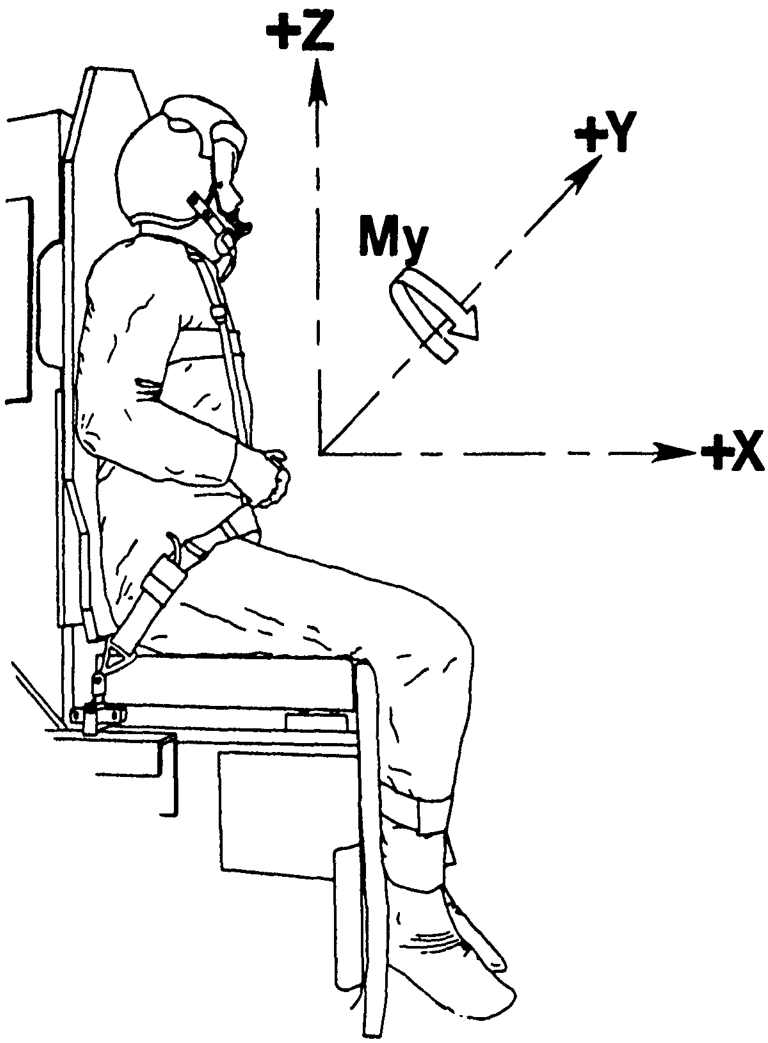
1. ALL TRANSDUCERS EXCEPT THE CARRIAGE ACCELEROMETERS AND THE CARRIAGE VELOCITY TACHOMETER WERE REFERENCED TO THE SEAT COORDINATE SYSTEM. THE CARRIAGE TACHOMETER WAS WIRED TO PROVIDE A POSITIVE OUTPUT VOLTAGE DURING FREEFALL. THE CARRIAGE ACCELEROMETERS WERE REFERENCED TO THE CARRIAGE COORDINATE SYSTEM.

2. THE LINEAR ACCELEROMETERS WERE WIRED TO PROVIDE A POSITIVE OUTPUT VOLTAGE WHEN THE ACCELERATION EXPERIENCED BY THE ACCELEROMETER WAS APPLIED IN THE +x, +y OR +z DIRECTION AS SHOWN.

3. THE ANGULAR Ry ACCELEROMETERS WERE WIRED TO PROVIDE A POSITIVE OUTPUT VOLTAGE WHEN THE ANGULAR ACCELERATION EXPERIENCED BY THE ANGULAR ACCELEROMETER WAS APPLIED IN THE +y DIRECTION ACCORDING TO THE RIGHT HAND RULE AS SHOWN.

4. THE LOAD CELLS AND LOAD LINKS WERE WIRED TO PROVIDE A POSITIVE OUTPUT VOLTAGE WHEN THE FORCE EXERTED BY THE LOAD CELL ON THE SUBJECT WAS APPLIED IN THE +x, +y OR +z DIRECTION AS SHOWN.

FIGURE A-7: AAMRL/BBP COORDINATE SYSTEM



1. THE ADAM MANIKIN FORCES AND TORQUES WERE REFERENCED TO THE MANIKIN COORDINATE SYSTEM.

2. THE NECK AND LUMBAR LOAD CELLS WERE WIRED TO PROVIDE A POSITIVE OUTPUT VOLTAGE WHEN THE FORCE EXERTED BY THE LOAD CELL, ON THE NECK OR LUMBAR, WAS APPLIED IN THE +x, +y OR +z DIRECTION AS SHOWN.

3. THE My TORQUE TRANSDUCERS WERE WIRED TO PROVIDE A POSITIVE OUTPUT VOLTAGE WHEN THE TORQUE EXPERIENCED BY THE TRANSDUCERS WAS APPLIED IN THE +y DIRECTION ACCORDING TO THE RIGHT HAND RULE AS SHOWN.

FIGURE A-8: MANIKIN COORDINATE SYSTEM

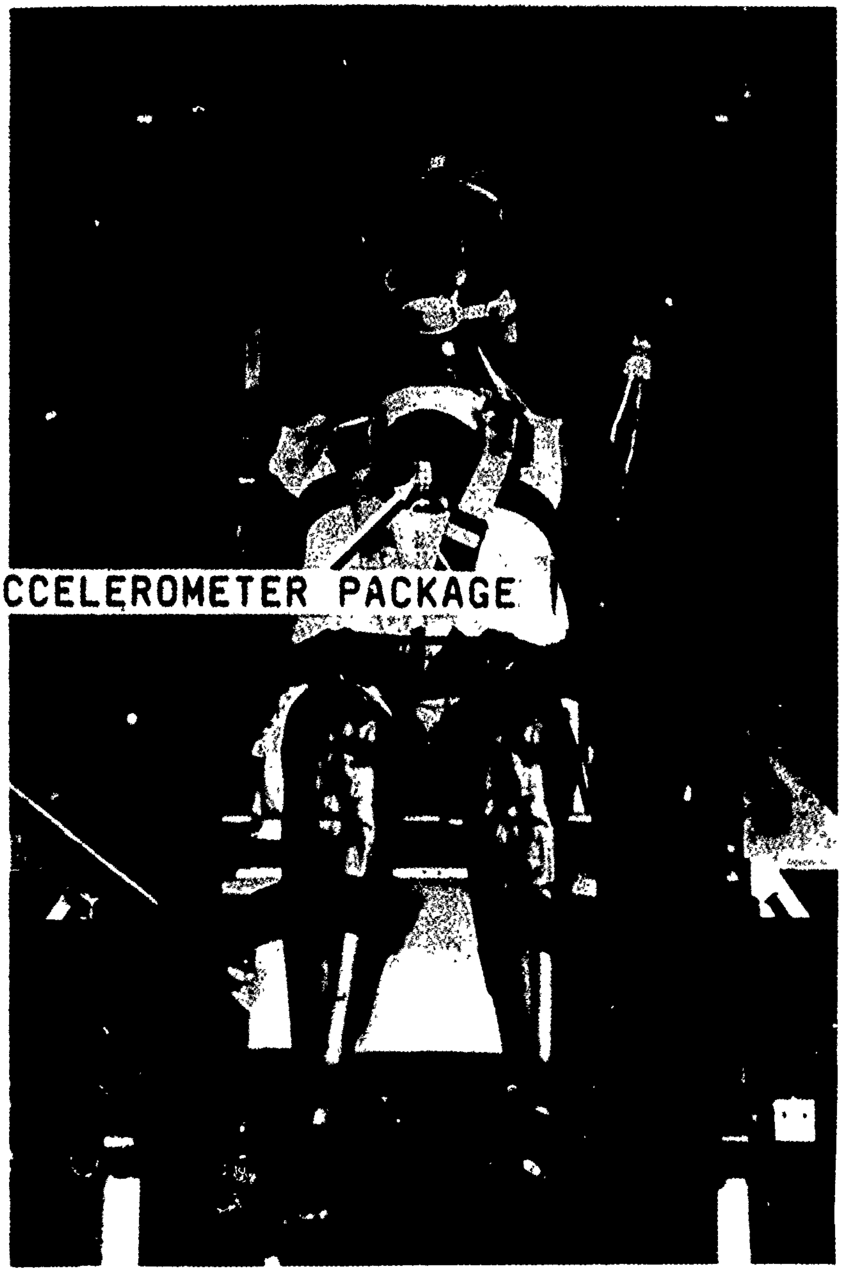
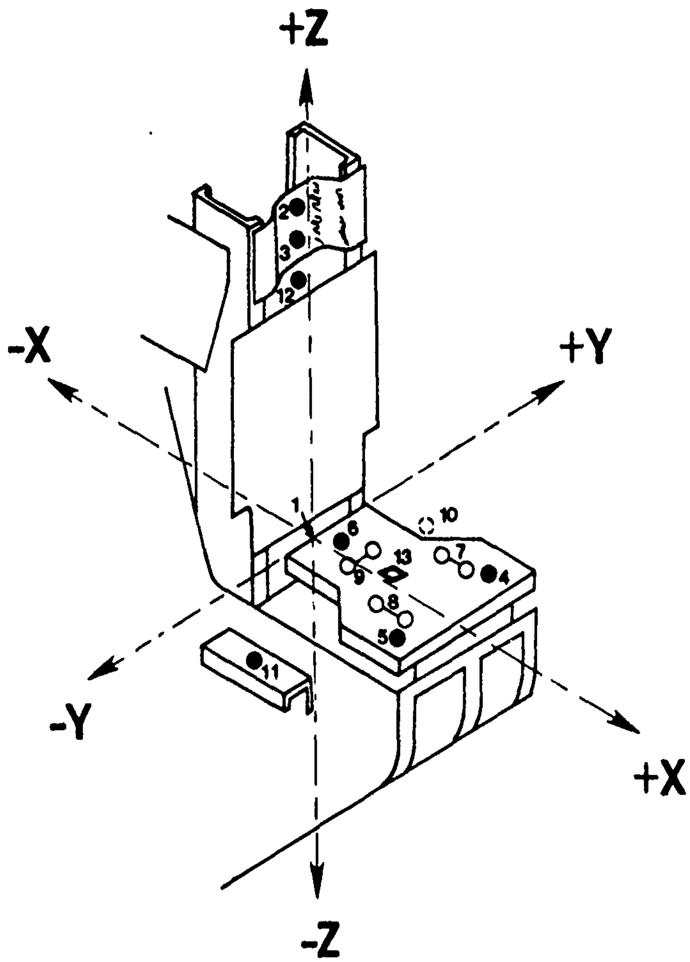


FIGURE A-9: CHEST ACCELEROMETER PACKAGE



NO.	DESCRIPTION	NO.	DESCRIPTION
1	SEAT REFERENCE POINT	8	RIGHT SEAT X FORCE
2	UPPER HEADREST X FORCE	9	CENTER SEAT Y FORCE
3	LOWER HEADREST X FORCE	10	LEFT LAP BELT FORCE
4	LEFT SEAT Z FORCE	11	RIGHT LAP BELT FORCE
5	RIGHT SEAT Z FORCE	12	SHOULDER FORCE
6	CENTER SEAT Z FORCE	13	SEAT X, Y & Z ACCELERATION
7	LEFT SEAT X FORCE		

ITEM 10 NOT SHOWN

THE HEADREST WAS ADJUSTABLE UP OR DOWN DEPENDING ON EACH SUBJECT. HEADREST LOAD CELL NUMBERS 2 AND 3 MOVE WITH THE HEADREST. THE MEASUREMENTS FOR THE HEADREST LOAD CELLS WERE TAKEN WHEN THE TOP MOUNTING HOLES IN THE HEAD REST WERE LINED UP WITH THE TOP HOLES IN THE FRAME SUPPORT.

FIGURE A-10a: TRANSDUCER LOCATIONS AND DIMENSIONS (PAGE 1 OF 2)

ALL DIMENSIONS ARE REFERENCED TO THE SEAT REFERENCE POINT (SRP). THE SEAT REFERENCE POINT IS LOCATED AT THE INTERSECTION OF THE SEAT PAN CENTER LINE AND THE SEAT BACK CENTER LINE (z AXIS).

CONTACT POINT DIMENSIONS IN INCHES (CM)

NO.	X	Y	Z
1	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
2	- 0.31 (- 0.80)	0.00 (0.00)	37.38 (94.95)
3	- 0.31 (- 0.80)	0.00 (0.00)	32.47 (82.48)
4	17.90 (45.46)	5.00 (12.70)	- 1.22 (- 3.10)
5	17.90 (45.46)	- 5.00 (-12.70)	- 1.22 (- 3.10)
6	6.68 (16.96)	0.00 (0.00)	- 1.22 (- 3.10)
7	10.00 (25.41)	6.00 (15.25)	- 1.85 (- 4.70)
8	10.00 (25.41)	- 6.00 (-15.25)	- 1.85 (- 4.70)
9	9.26 (23.51)	1.99 (5.05)	- 1.85 (- 4.70)
10	0.81 (2.06)	9.00 (22.86)	- 1.61 (- 4.10)
11	0.81 (2.06)	- 9.00 (-22.86)	- 1.61 (- 4.10)
12	- 5.47 (-13.90)	0.00 (0.00)	27.39 (69.58)
13	12.33 (31.31)	0.00 (0.00)	- 1.69 (- 4.30)

SEE FIGURE A-10a FOR DESCRIPTIONS OF TRANSDUCER ITEM NUMBERS

THE SEAT ACCELEROMETER MEASUREMENTS (ITEM 13) ARE TAKEN AT THE CENTER OF THE ACCELEROMETER BLOCK.

THE CONTACT POINT IS THE POINT ON THE LOAD CELL AT WHICH THE EXTERNAL FORCE IS APPLIED.

THE MEASUREMENTS FOR THE LOAD CELLS WHICH ANCHOR THE HARNESS (ITEMS 10, 11 & 12) ARE TAKEN AT THE POINT WHERE THE HARNESS IS ATTACHED TO THE LOAD CELL.

FIGURE A-10b: TRANSDUCER LOCATIONS AND DIMENSIONS (PAGE 2 OF 2)

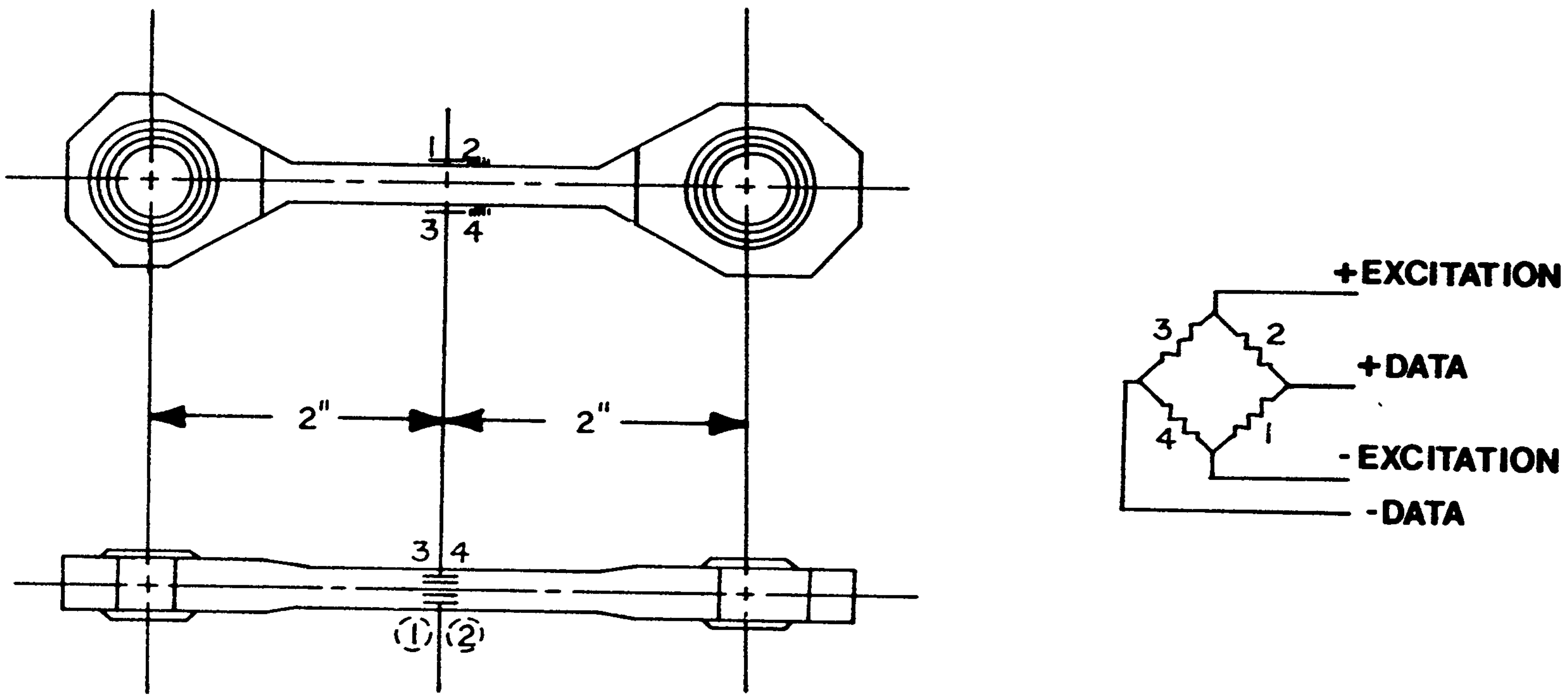
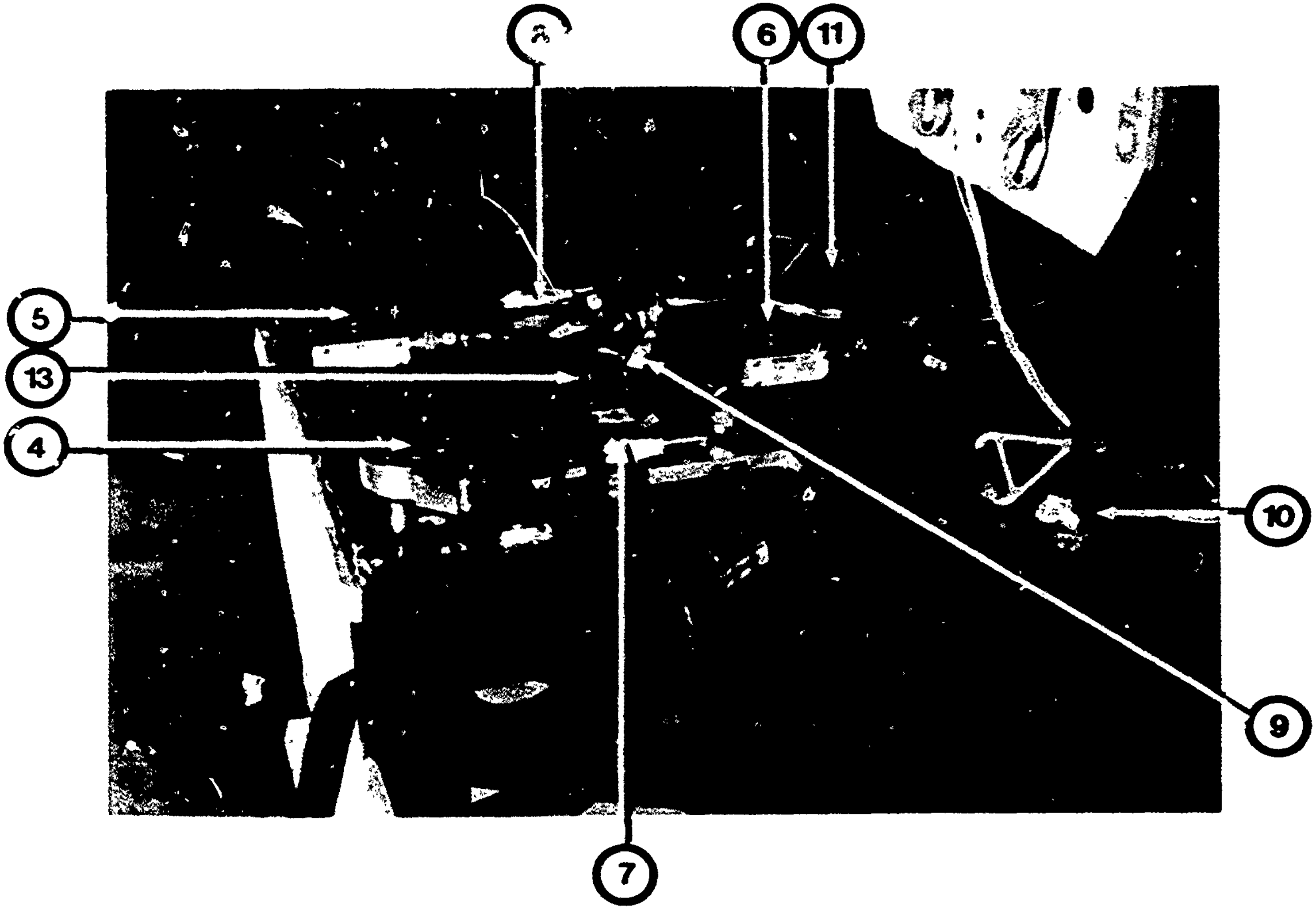
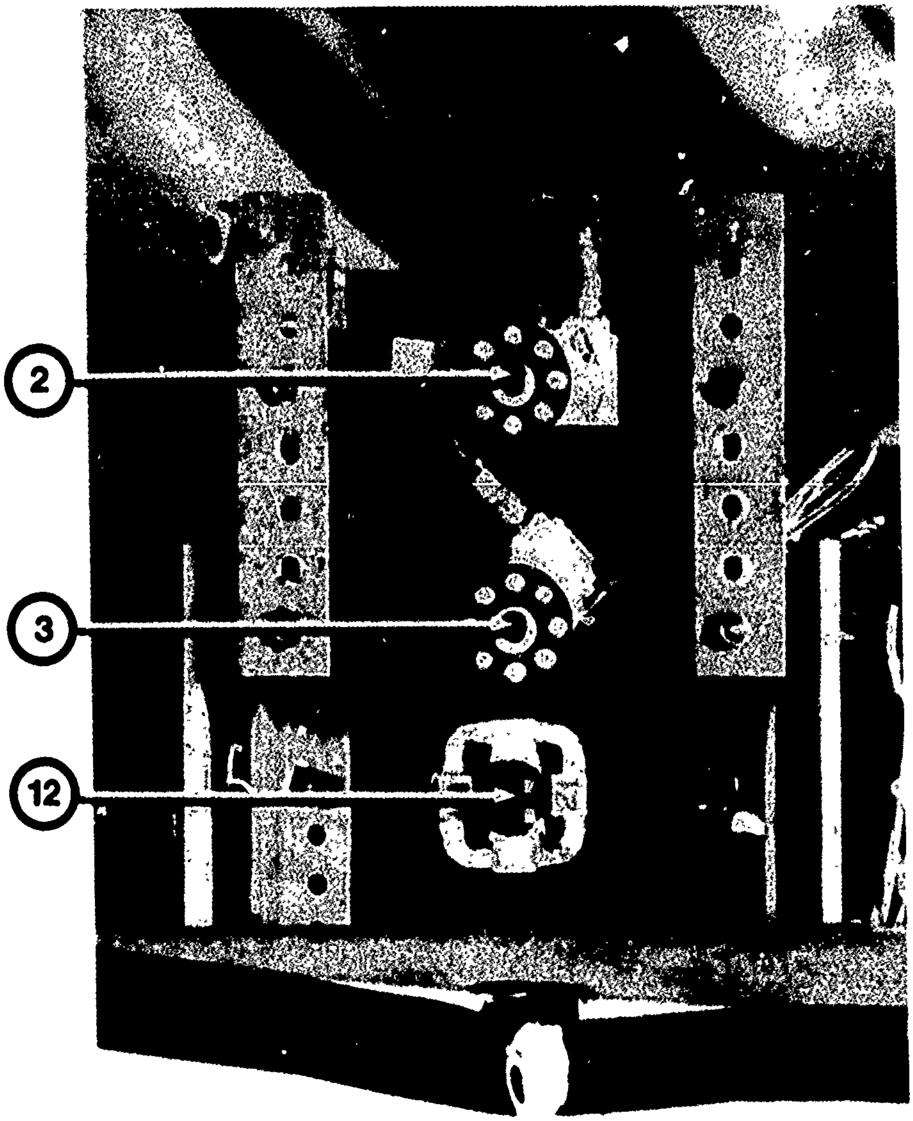


FIGURE A-11: LOAD LINK INSTRUMENTATION



NOTE: REFER TO FIGURE A-10a FOR A DESCRIPTION OF THE TRANSDUCER ITEM NUMBERS.

FIGURE A-12: SEAT PAN INSTRUMENTATION



NOTE: REFER TO FIGURE A-10a FOR A DESCRIPTION OF THE TRANSDUCER ITEM NUMBERS.

FIGURE A-13: HEADREST AND SHOULDER LOAD CELL INSTRUMENTATION

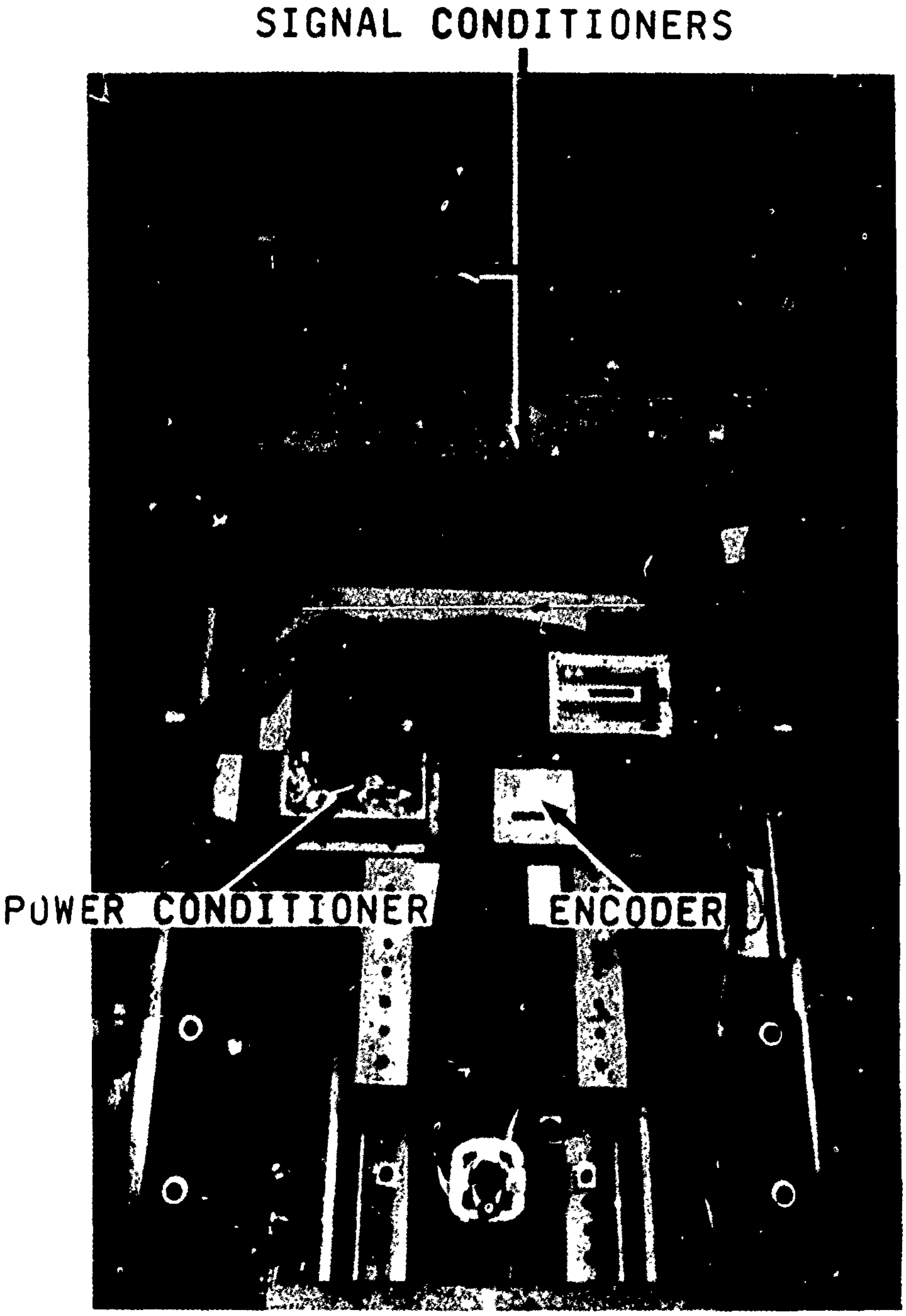
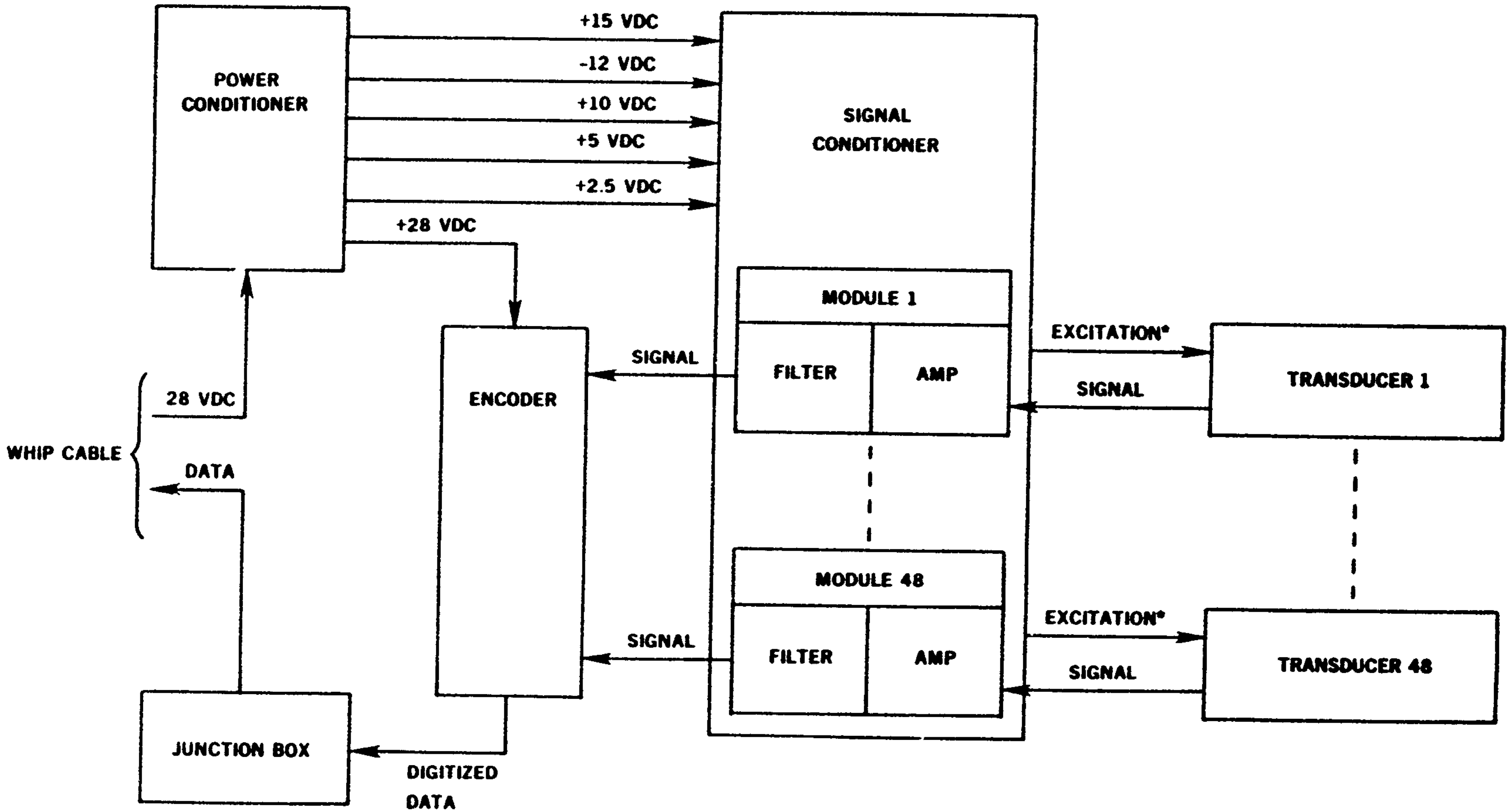


FIGURE A-14: ADACS INSTALLATION



* +10 OR +5 VDC, FOR BRIDGE-TYPE TRANSDUCERS ONLY.

FIGURE A-15: AUTOMATIC DATA ACQUISITION AND CONTROL SYSTEM

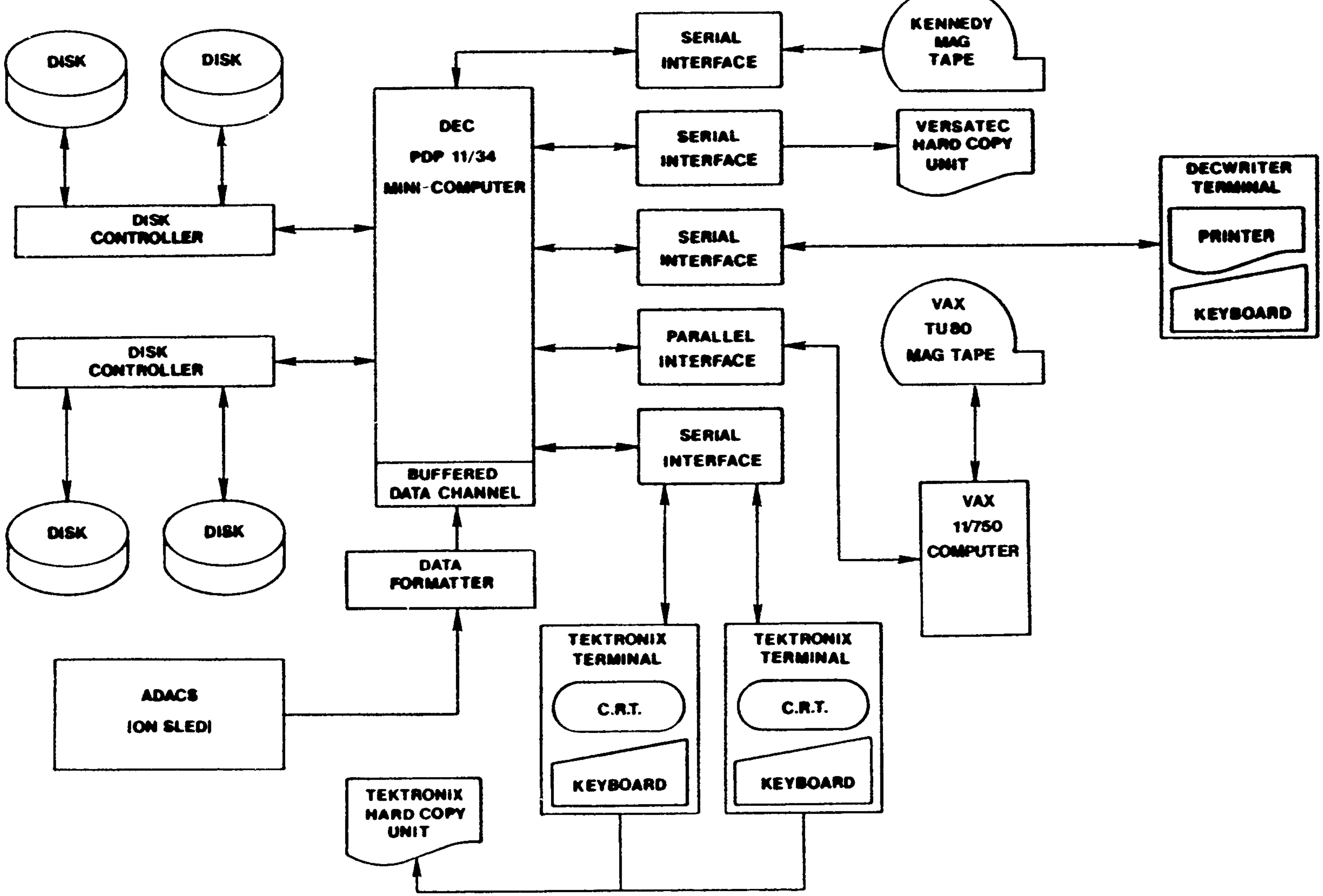
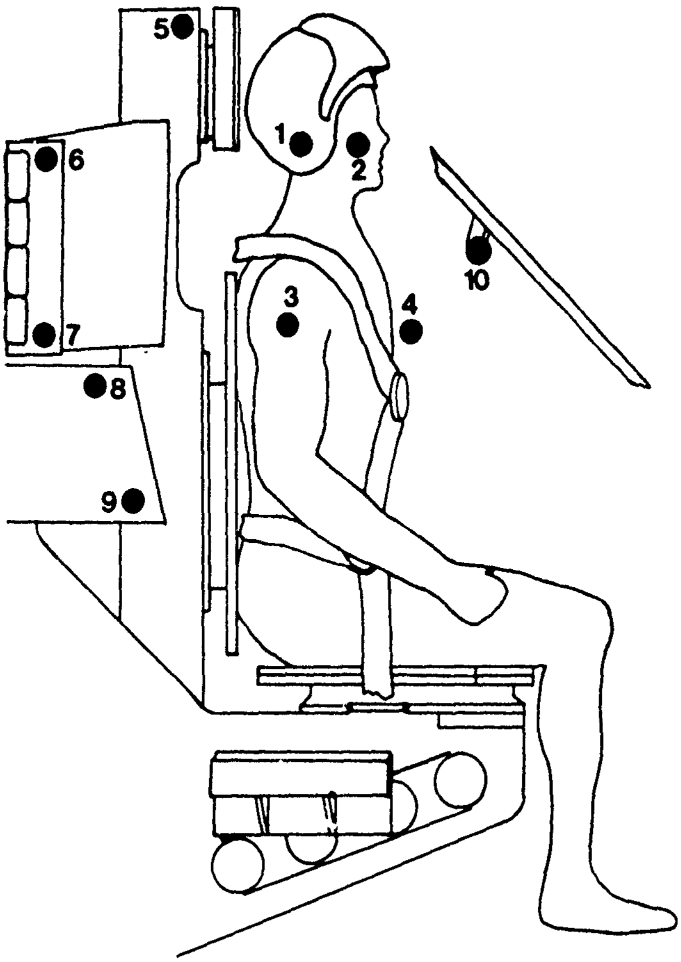


FIGURE A-16: DATA ACQUISITION AND STORAGE SYSTEM BLOCK DIAGRAM



ALL DIMENSIONS ARE REFERENCED TO THE SEAT REFERENCE POINT (SRP). THE SEAT REFERENCE POINT IS LOCATED AT THE INTERSECTION OF THE SEAT PAN CENTER LINE AND THE SEAT BACK CENTER LINE (z AXIS).

	DESCRIPTION	DIMENSIONS IN FEET		
		x	y	z
1.	HELMET	-	-	-
2.	CHEEK	-	-	-
3.	SHOULDER	-	-	-
4.	CHEST	-	-	-
5.	UPPER FRAME	-0.1411	-0.5399	+3.3953
6.	UPPER NUMBER PLATE	-0.7979	-0.7887	+2.6854
7.	LOWER NUMBER PLATE	-0.8225	-0.7904	+1.8163
8.	CENTER FRAME	-0.6312	-0.6337	+1.4196
9.	LOWER CENTER FRAME	-0.3632	-0.6616	+0.8258
10.	CAMERA STRUT	+2.0518	-2.4725	+2.3162

FIGURE A-17: FIDUCIAL TARGET LOCATIONS

FIGURE A-18: FIDUCIAL TARGETS

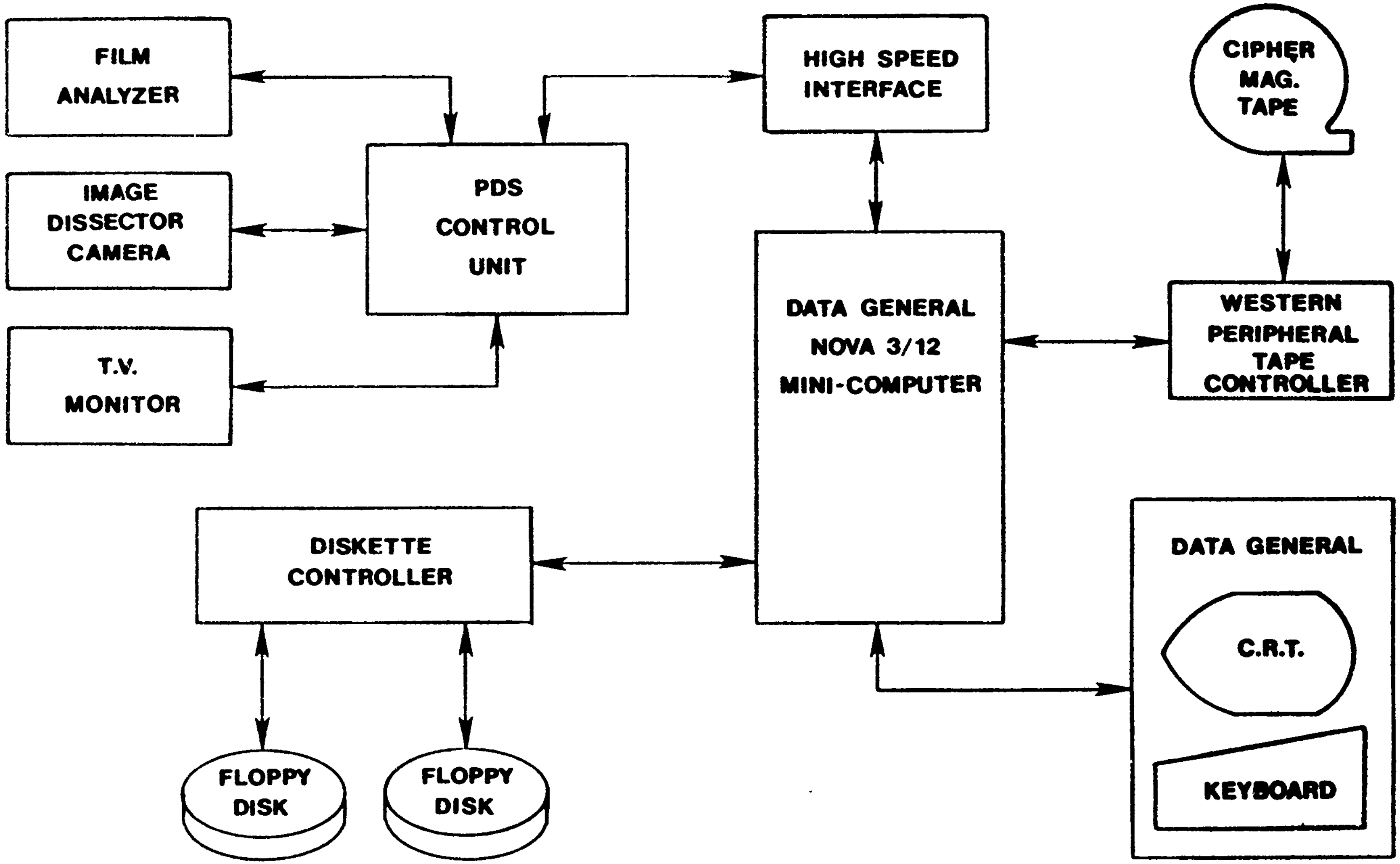


FIGURE A-19: AUTOMATIC FILM READER

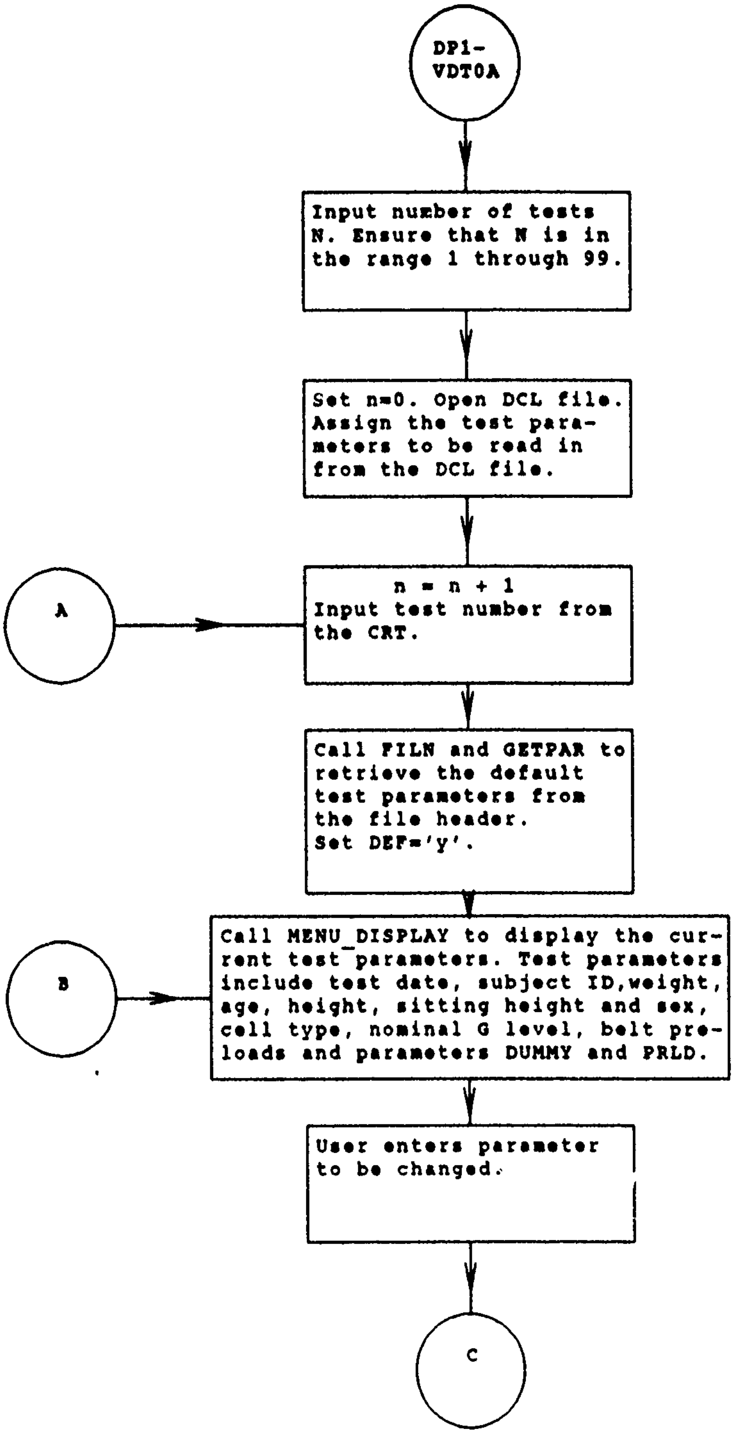


FIGURE A-20a: PROGRAM DP1VDT0A FLOWCHART (PAGE 1 OF 3)

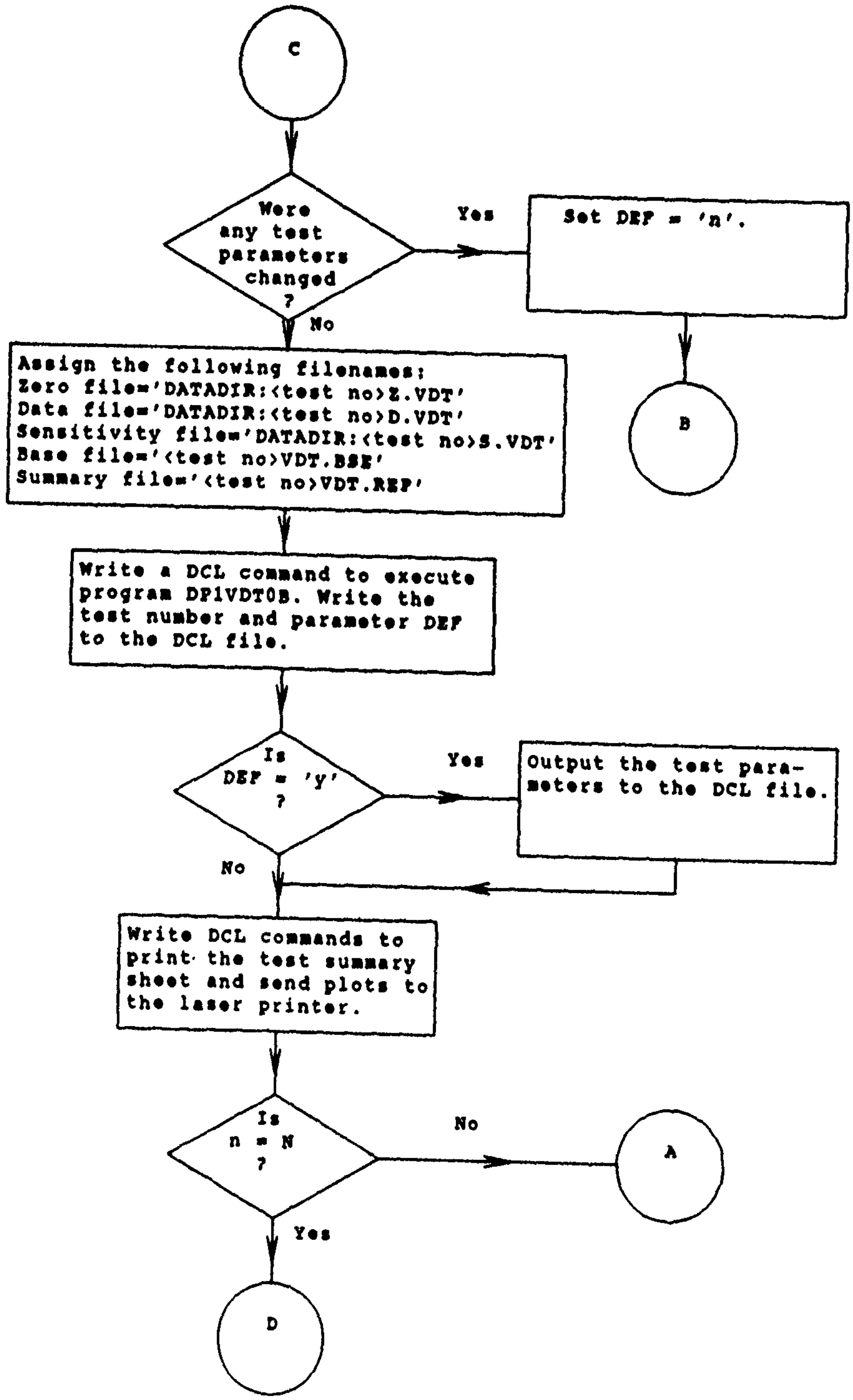


FIGURE A-20b: PROGRAM DP1VDTØA FLOWCHART (PAGE 2 OF 3)

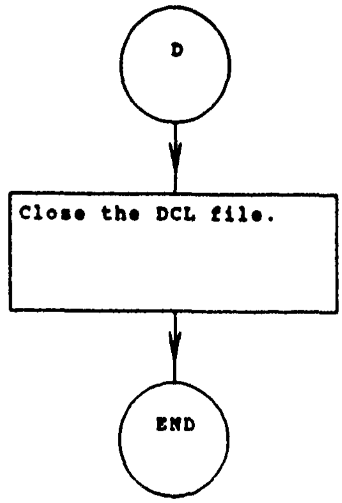


FIGURE A-20c: PROGRAM DP1VDTØA FLOWCHART (PAGE 3 OF 3)

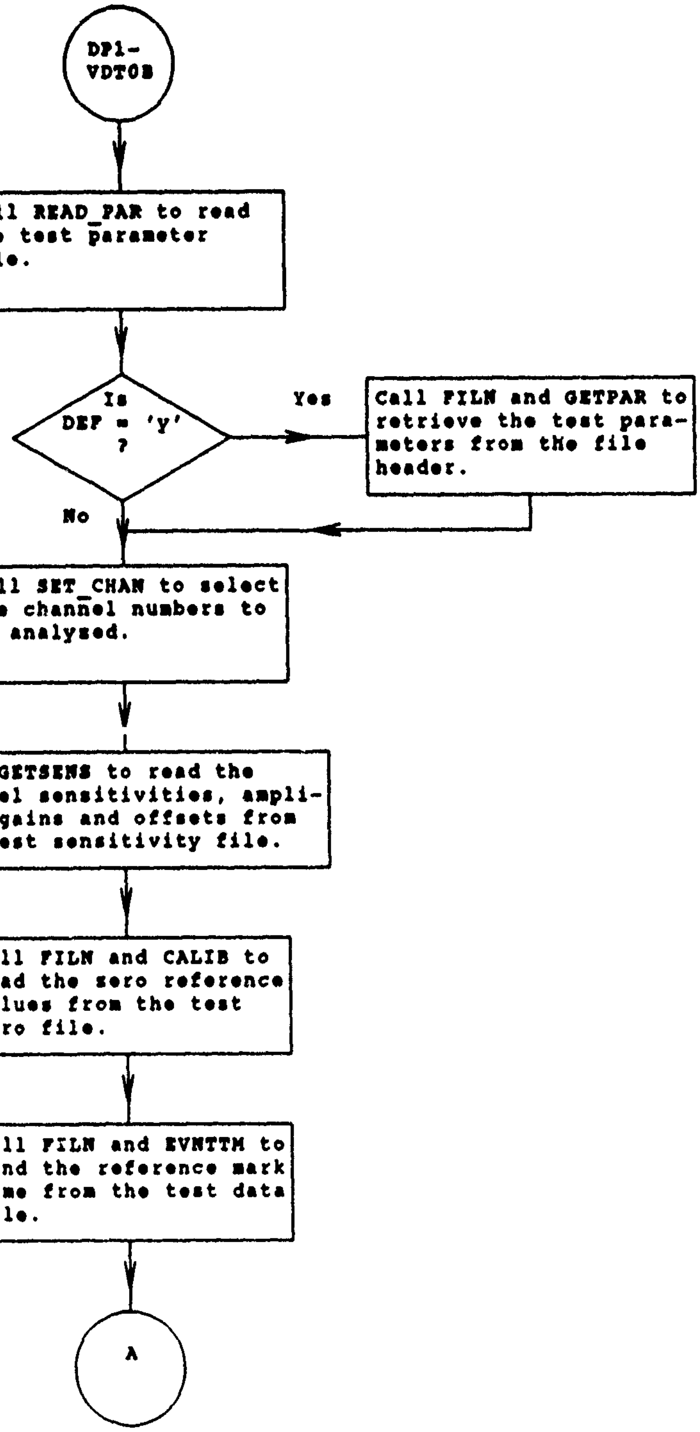


FIGURE A-21a: PROGRAM DP1VDTØB FLOWCHART (PAGE 1 OF 8)

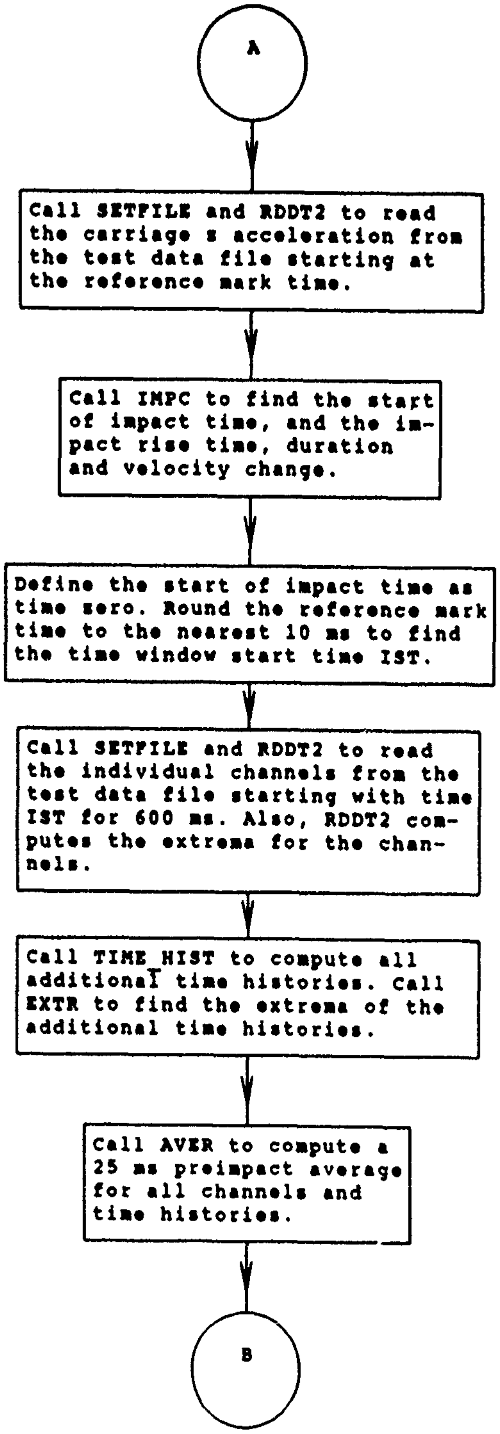


FIGURE A-21b: PROGRAM DP1VDT0B FLOWCHART (PAGE 2 OF 8)

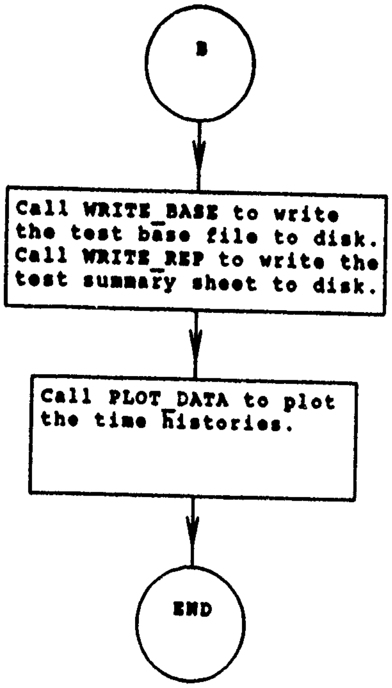
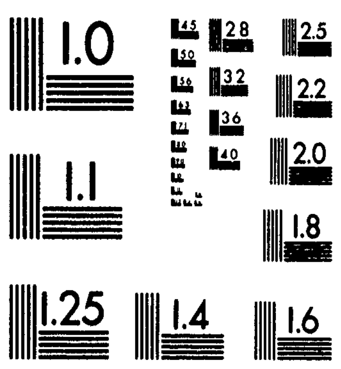
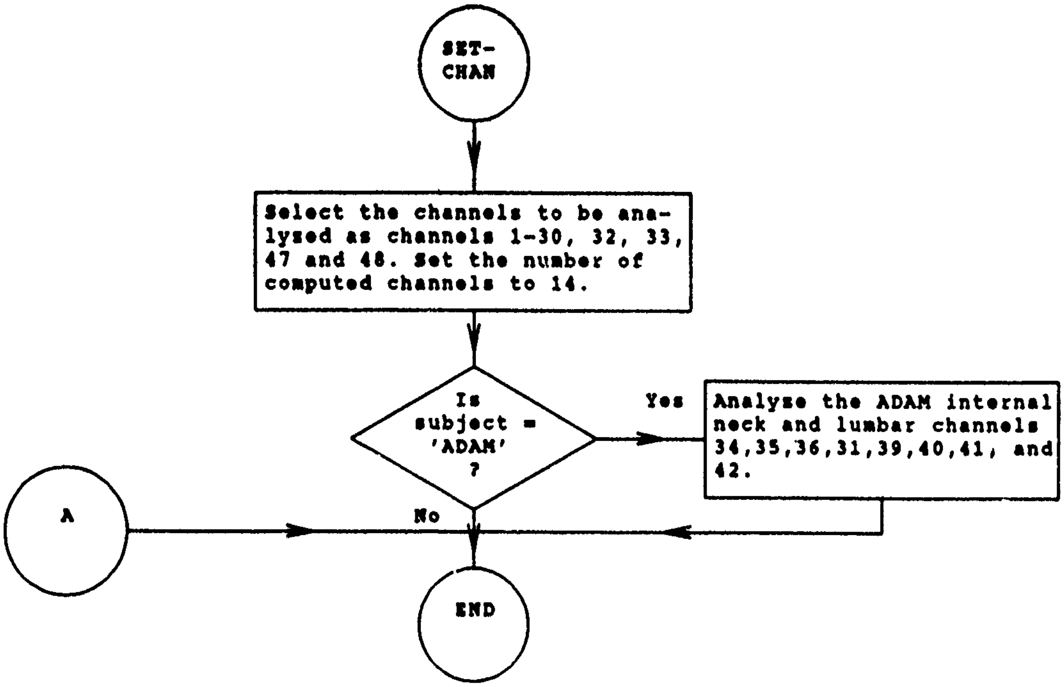


FIGURE A-21c: PROGRAM DP1VDTØB FLOWCHART (PAGE 3 OF 8)



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS
STANDARD REFERENCE MATERIAL 1010a
(ANSI and ISO TEST CHART No 2)



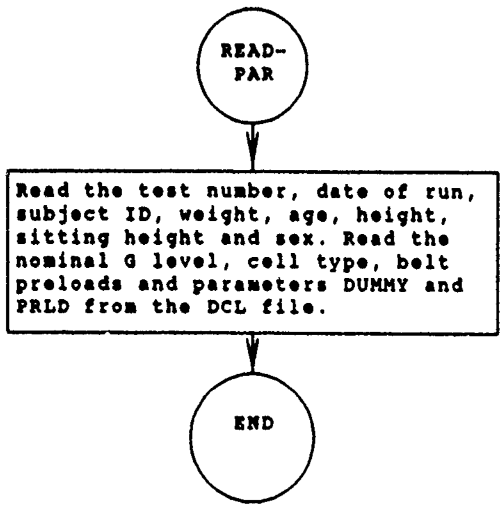


FIGURE A-21d: PROGRAM DP1VDT0B FLOWCHART (PAGE 4 OF 8)

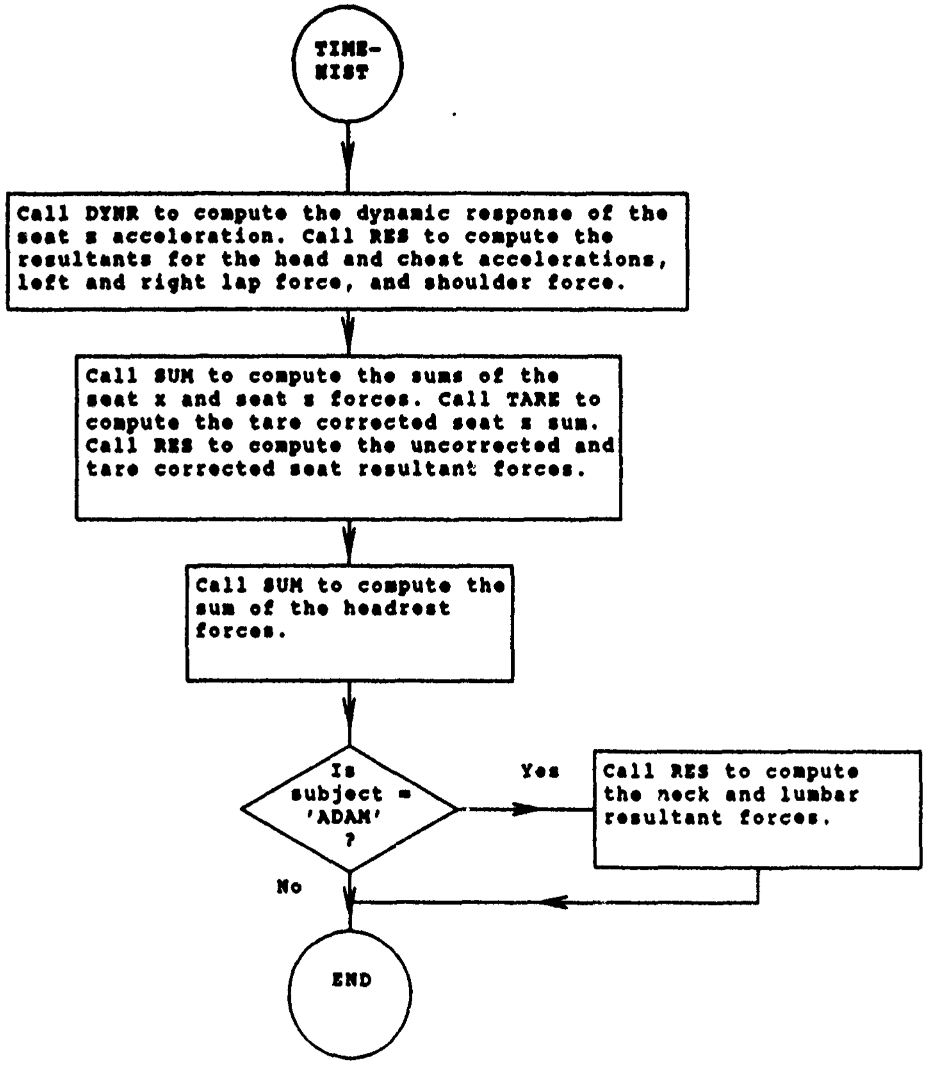


FIGURE A-21e: PROGRAM DP1VDTØB FLOWCHART (PAGE 5 OF 8)

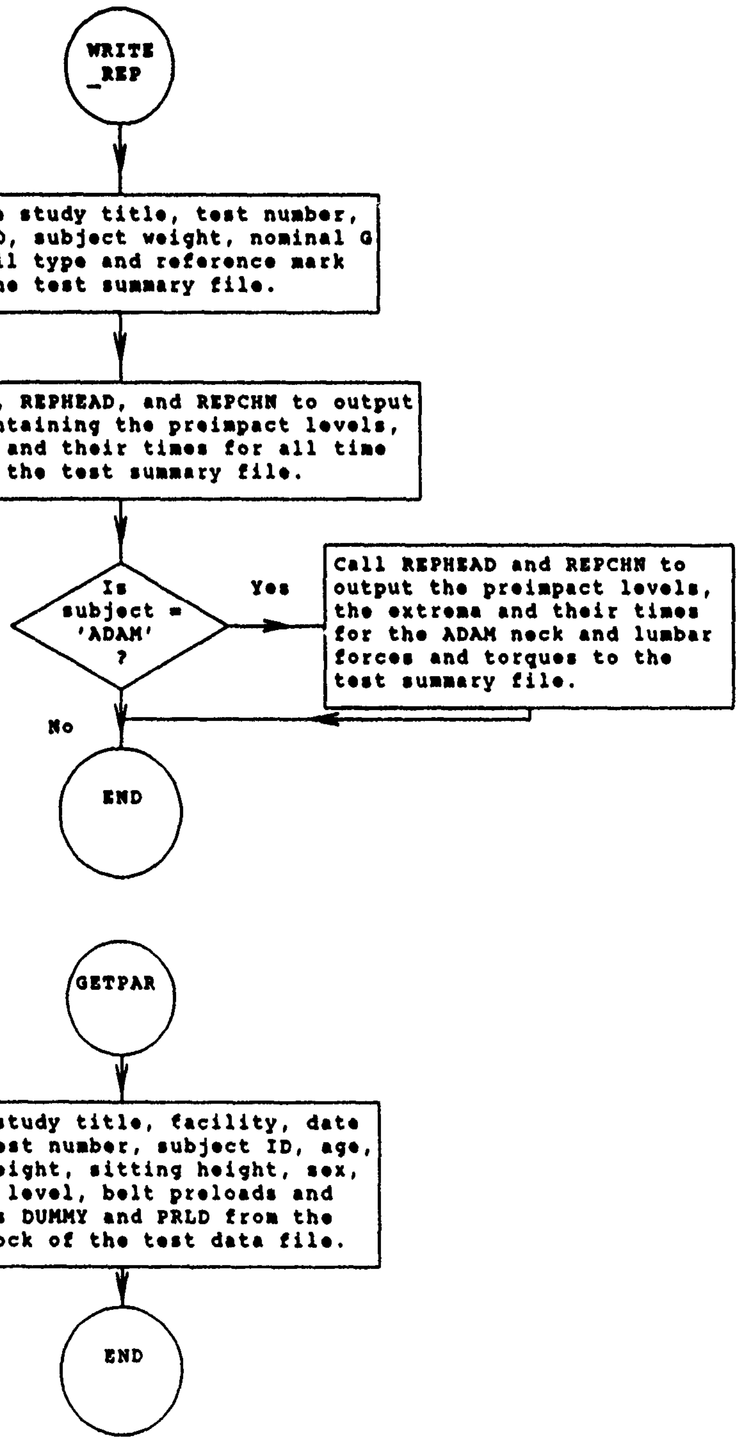


FIGURE A-21f: PROGRAM DP1VDT0B FLOWCHART (PAGE 6 OF 8)

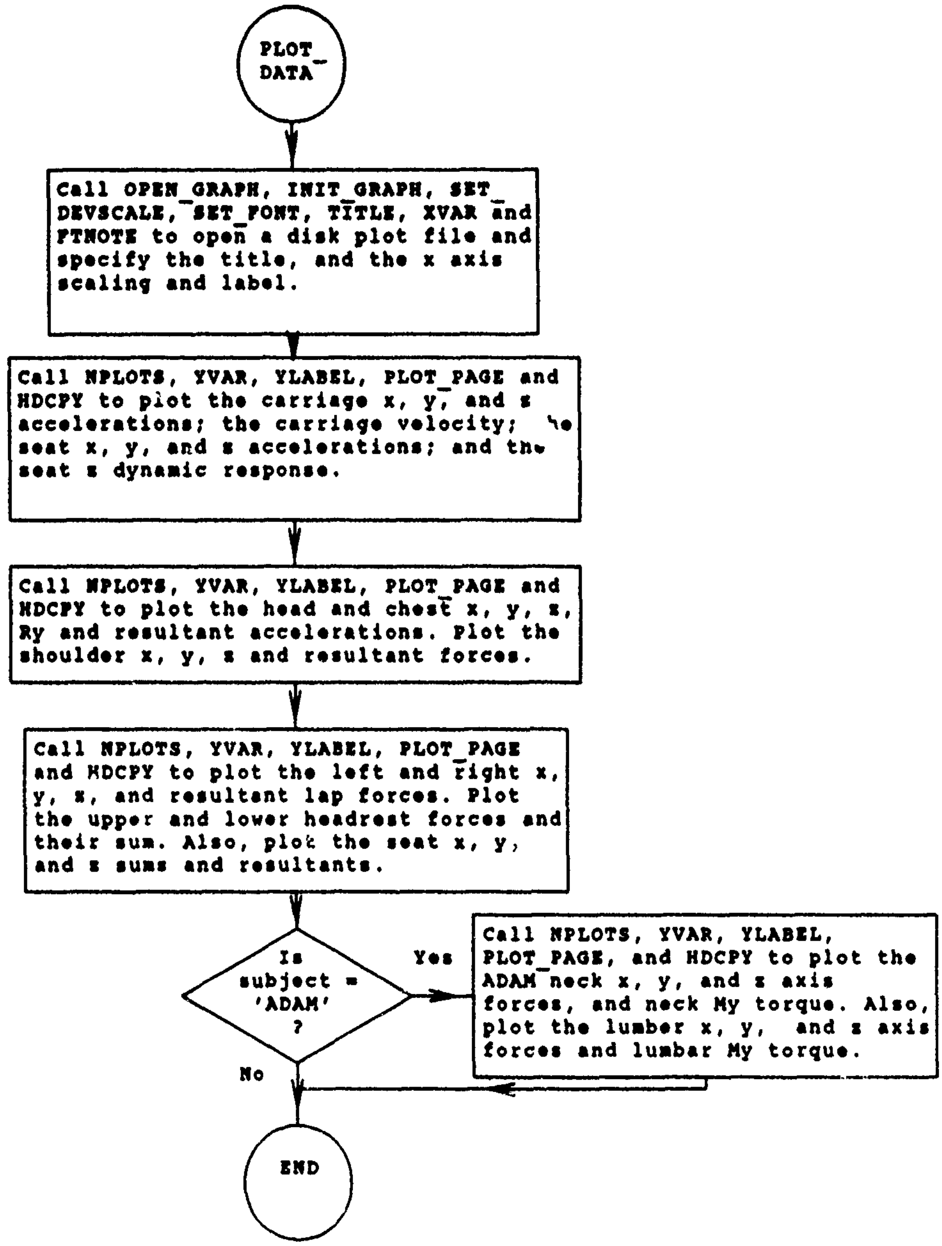


FIGURE A-21g: PROGRAM DP1VDTØB FLOWCHART (PAGE 7 OF 8)

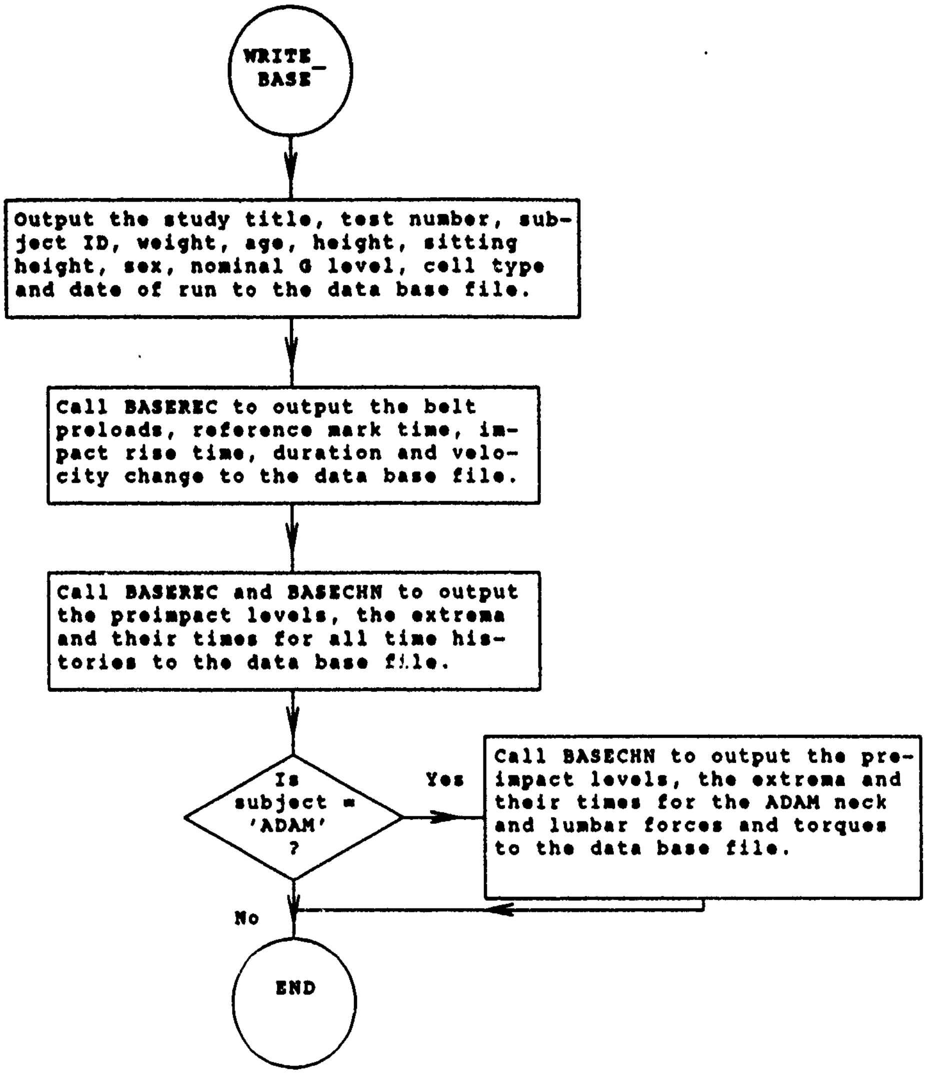


FIGURE A-21h: PROGRAM DP1VDTØB FLOWCHART (PAGE 8 OF 8)

APPENDIX B

DATA SUMMARIES AND GRAPHS

DP1 STUDY TEST: 1782 SUBJ: ADAM-L WT: 218.0 NOM G: 8.0 CELL: N1

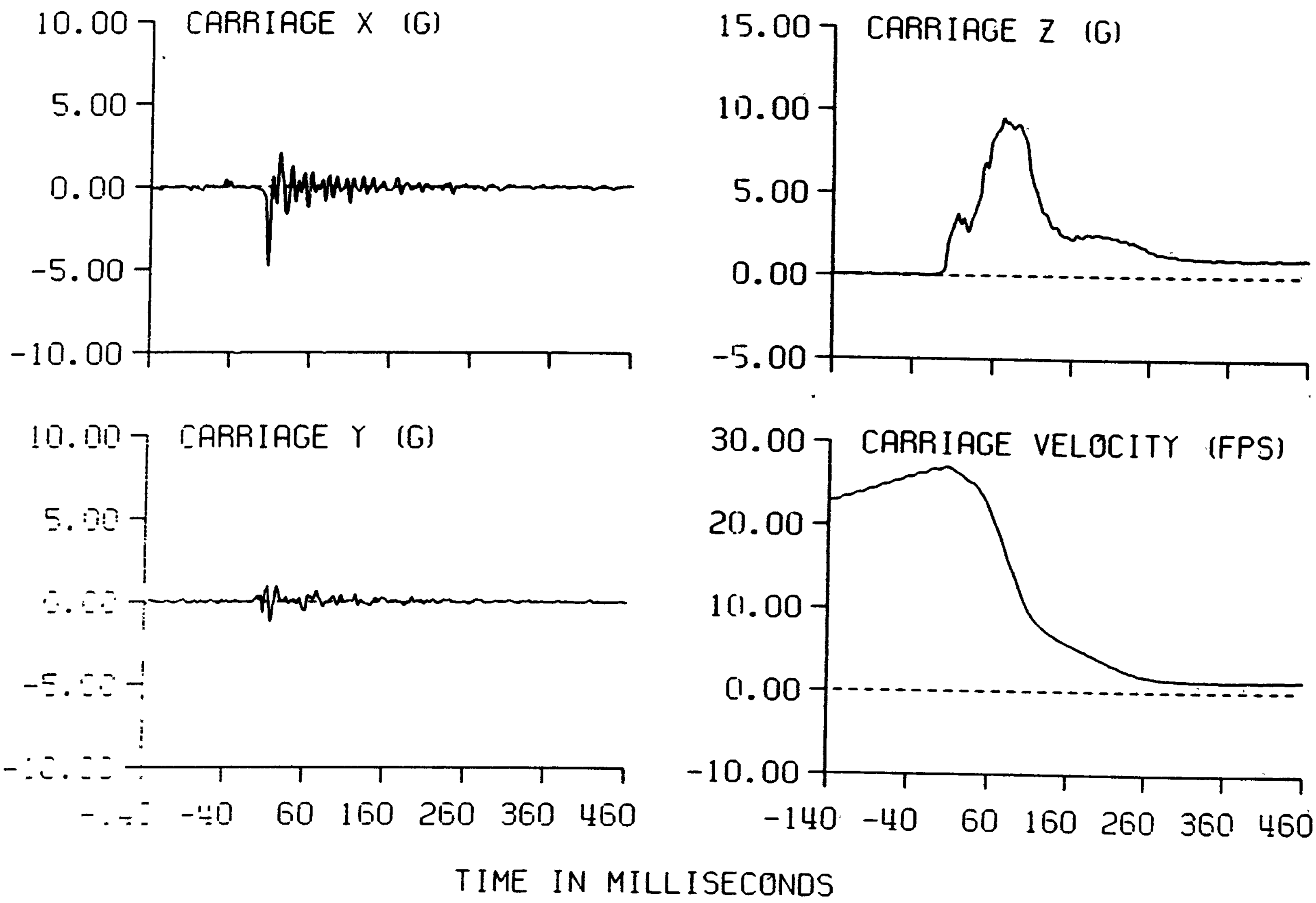
DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
REFERENCE MARK TIME (MS)				-140.	
2.5V EXT PWR (VOLTS)	2.50	2.50	2.50	0.	2.
10V EXT PWR (VOLTS)	10.00	10.00	10.00	259.	358.
CARRIAGE ACCELERATION (G)					
X AXIS	-0.04	2.05	-4.84	22.	8.
Y AXIS	0.00	0.93	-1.25	14.	18.
Z AXIS	0.02	9.60	0.34	72.	0.
Z AXIS PEAK 1		3.77		16.	
Z AXIS PEAK 2		9.60		72.	
CARRIAGE VELOCITY (FPS)	26.47	27.01	1.24	5.	360.
SEAT ACCELERATION (G)					
X AXIS	-0.07	1.84	-1.42	22.	56.
Y AXIS	0.00	2.35	-2.20	37.	30.
Z AXIS	-0.12	11.73	-0.32	64.	30.
Z AXIS DRI	-0.05	11.57	-1.18	102.	173.
HEAD ACCELERATION (G)					
X AXIS	0.07	1.36	-2.91	65.	131.
Y AXIS	0.18	0.91	-0.23	70.	143.
Z AXIS	-0.08	13.90	-0.18	80.	0.
RESULTANT	0.22	13.91	0.25	80.	8.
RY (RAD/SEC2)	-6.68	285.73	-196.88	74.	136.
CHEST ACCELERATION (G)					
X AXIS	-0.17	3.20	-1.04	83.	172.
Y AXIS	0.16	0.98	-0.11	83.	128.
Z AXIS	0.03	13.32	-0.09	82.	0.
RESULTANT	0.26	13.67	0.35	82.	4.
RY (RAD/SEC2)	1.00	476.83	-795.12	83.	76.
SHOULDER STRAP FORCES (LB)					
X AXIS	-12.00	-2.21	-51.29	361.	172.
Y AXIS	-0.15	9.64	-6.43	110.	76.
Z AXIS	0.16	46.20	0.02	68.	138.
RESULTANT	12.05	57.30	2.51	179.	362
HEADREST FORCES (LB)					
UPPER X AXIS	0.56	2.35	14.19	141.	63.
LOWER X AXIS	-0.98	11.55	4.61	59.	139.
X AXIS SUM	-0.42	8.39	13.84	59.	75.

DP1 STUDY TEST: 1782 SUBJ: ADAM-L WT: 218.0 NOM G: 8.0 CELL: N1

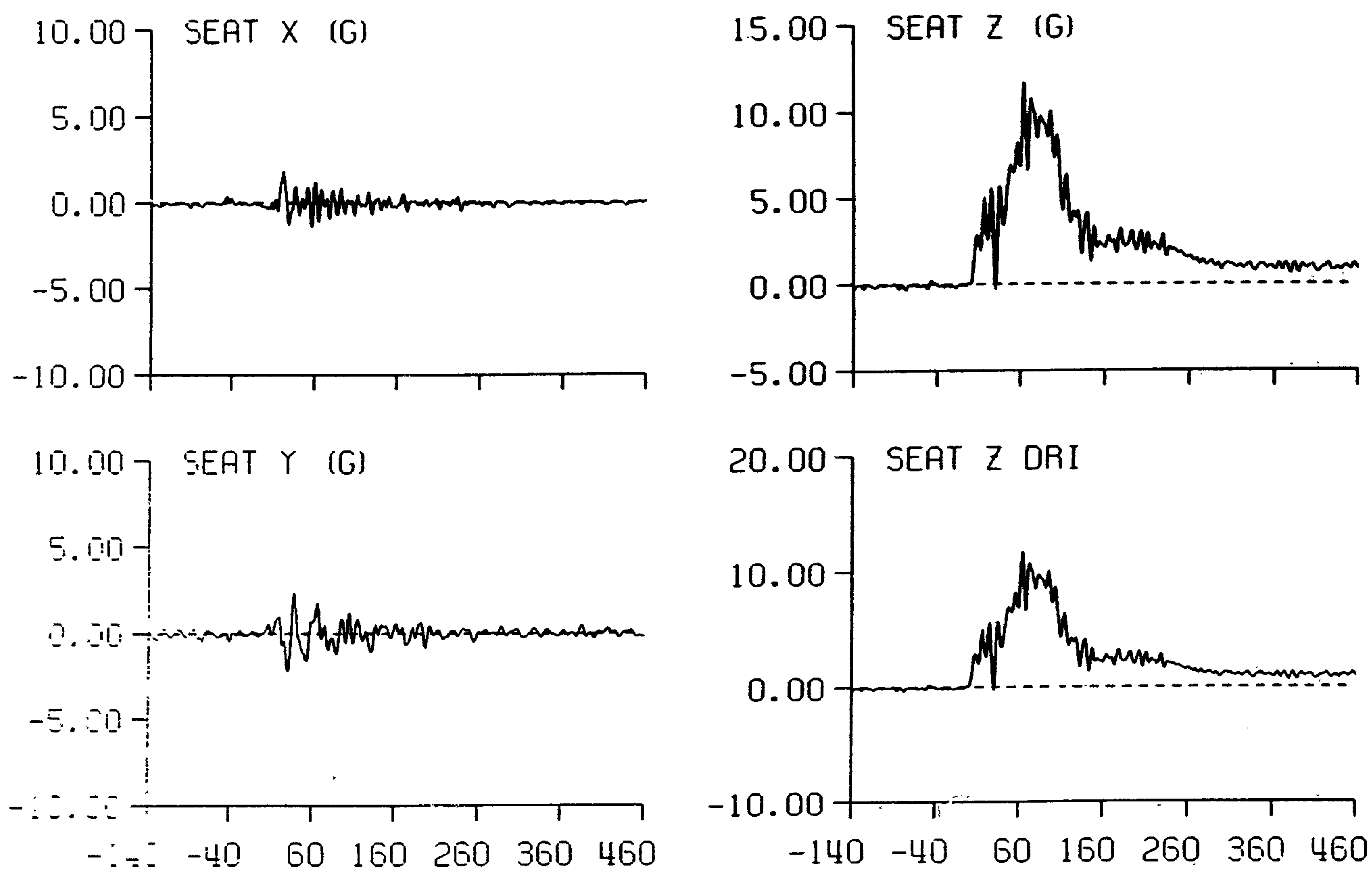
DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
LAP FORCES (LB)					
LEFT X AXIS	-22.60	2.58	-25.22	51.	1.
LEFT Y AXIS	6.63	8.16	-3.53	3.	31.
LEFT Z AXIS	-26.03	18.62	-28.52	72.	0.
LEFT RESULTANT	35.11	38.71	3.82	1.	25.
RIGHT X AXIS	-22.11	2.53	-22.74	36.	0.
RIGHT Y AXIS	-3.04	3.47	-3.47	38.	0.
RIGHT Z AXIS	-27.41	16.42	-29.10	74.	0.
RIGHT RESULTANT	35.36	37.10	1.34	0.	24.
SEAT FORCES (LB)					
LEFT X AXIS	9.28	22.58	-36.85	78.	130.
RIGHT X AXIS	-0.29	33.66	-71.67	24.	58.
X AXIS SUM	8.99	51.49	-71.97	24.	57.
Y AXIS	-10.04	111.90	-9.95	64.	0.
LEFT Z AXIS	2.35	242.28	1.75	95.	0.
RIGHT Z AXIS	-3.11	348.55	-3.11	84.	0.
CENTER Z AXIS	51.12	2178.88	48.48	76.	0.
Z AXIS SUM	50.36	2682.30	47.11	77.	0.
RESULTANT	52.31	2683.69	48.24	77.	0.
Z SUM MINUS TARE	71.40	2516.13	62.26	77.	2.
RESULTANT MINUS TARE	72.09	2516.25	62.40	77.	2.
ADAM NECK FORCE (LB)					
X AXIS	1.19	9.17	-37.28	346.	115.
Y AXIS	1.12	10.56	-5.59	68.	139.
Z AXIS	-13.18	142.95	-13.18	79.	0.
RESULTANT	13.38	143.61	1.55	79.	25.
ADAM NECK MY (IN-LB)	-2.40	91.00	-19.02	106.	19.
ADAM LUMBAR FORCE (LB)					
X AXIS	-2.40	187.39	-18.88	78.	381.
Y AXIS	-3.33	16.29	-19.30	60.	98.
Z AXIS	-63.03	965.25	65.17	76.	0.
RESULTANT	63.20	983.35	3.06	79.	17
ADAM LUMBAR MY (IN-LB)	-11.24	134.46	440.70	61.	83.

Page 2 of 2

DP1 STUDY TEST: 1782 SUBJ: ADAM-L CELL: N1

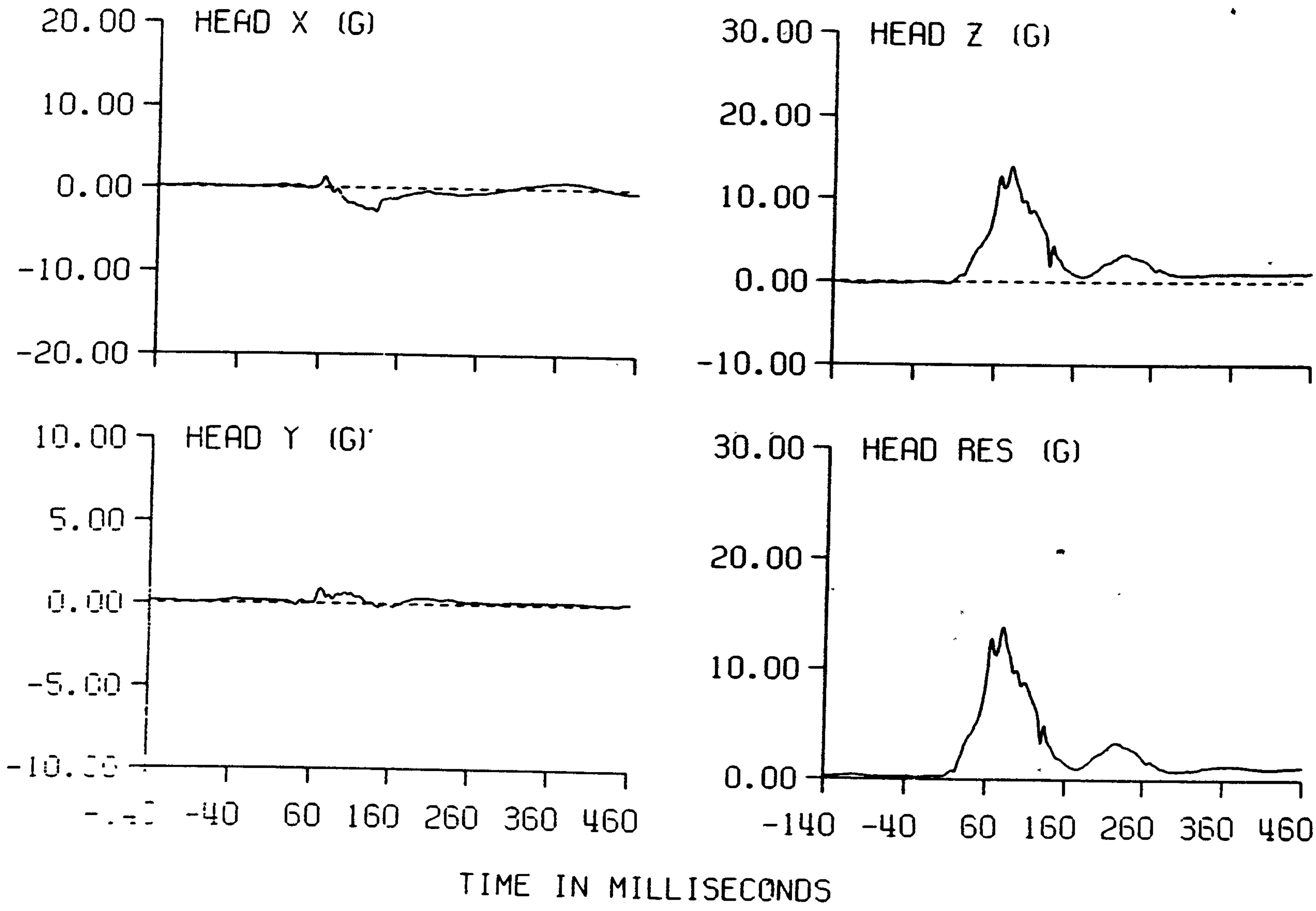


DP1 STUDY TEST: 1782 SUBJ: ADAM-L CELL: N1

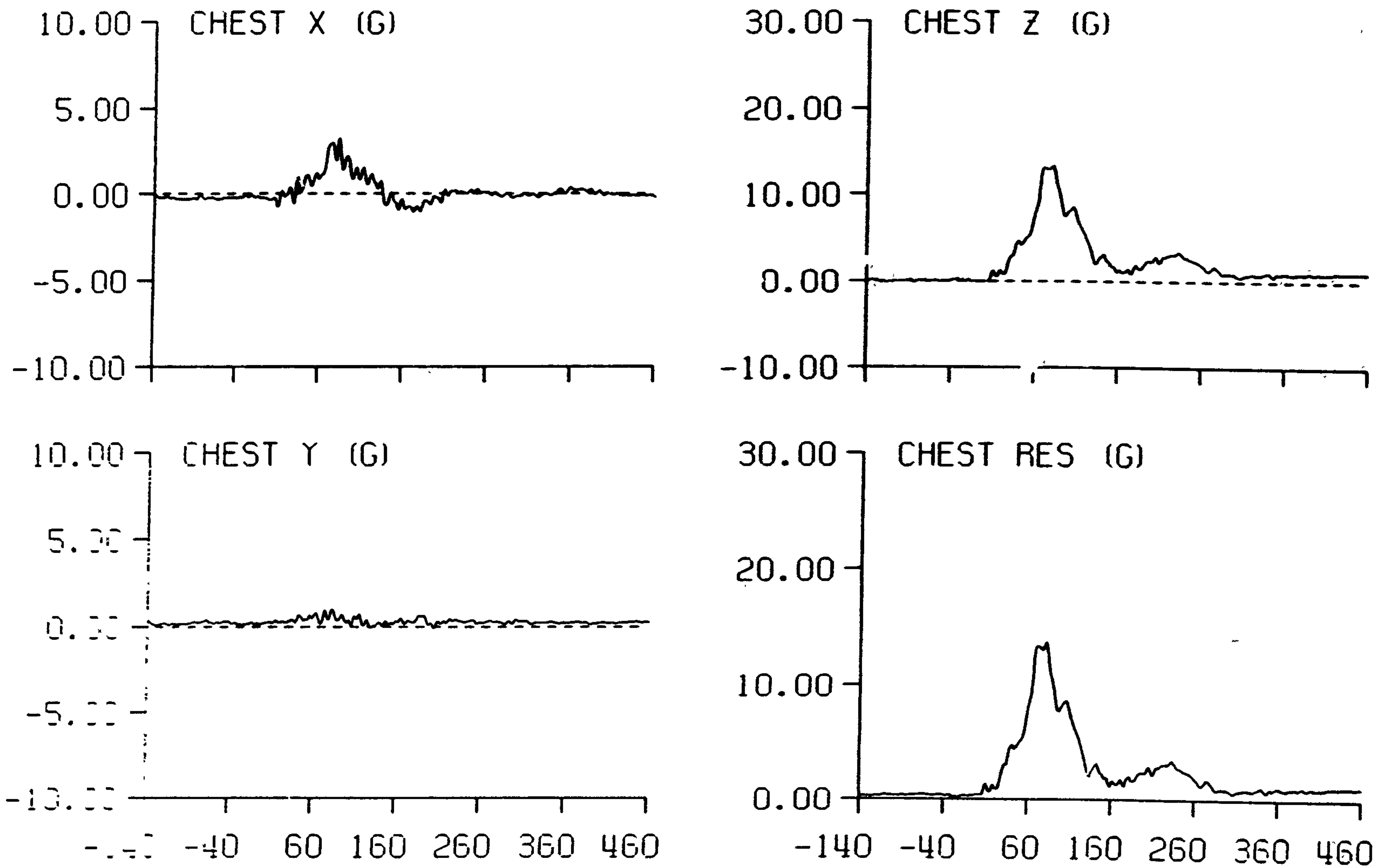


TIME IN MILLISECONDS

DP1 STUDY TEST: 1782 SUBJ: ADAM-L CELL: N1

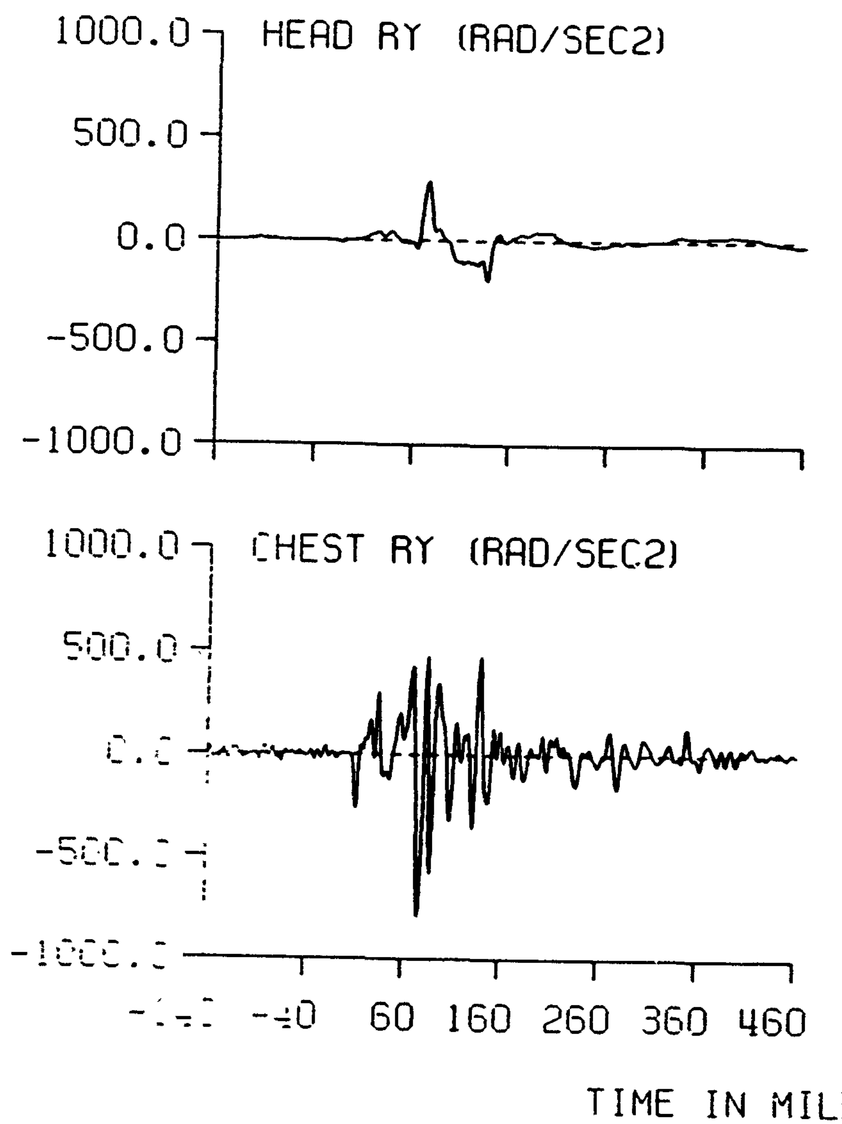


DP1 STUDY TEST: 1782 SUBJ: ADAM-L CELL: N1

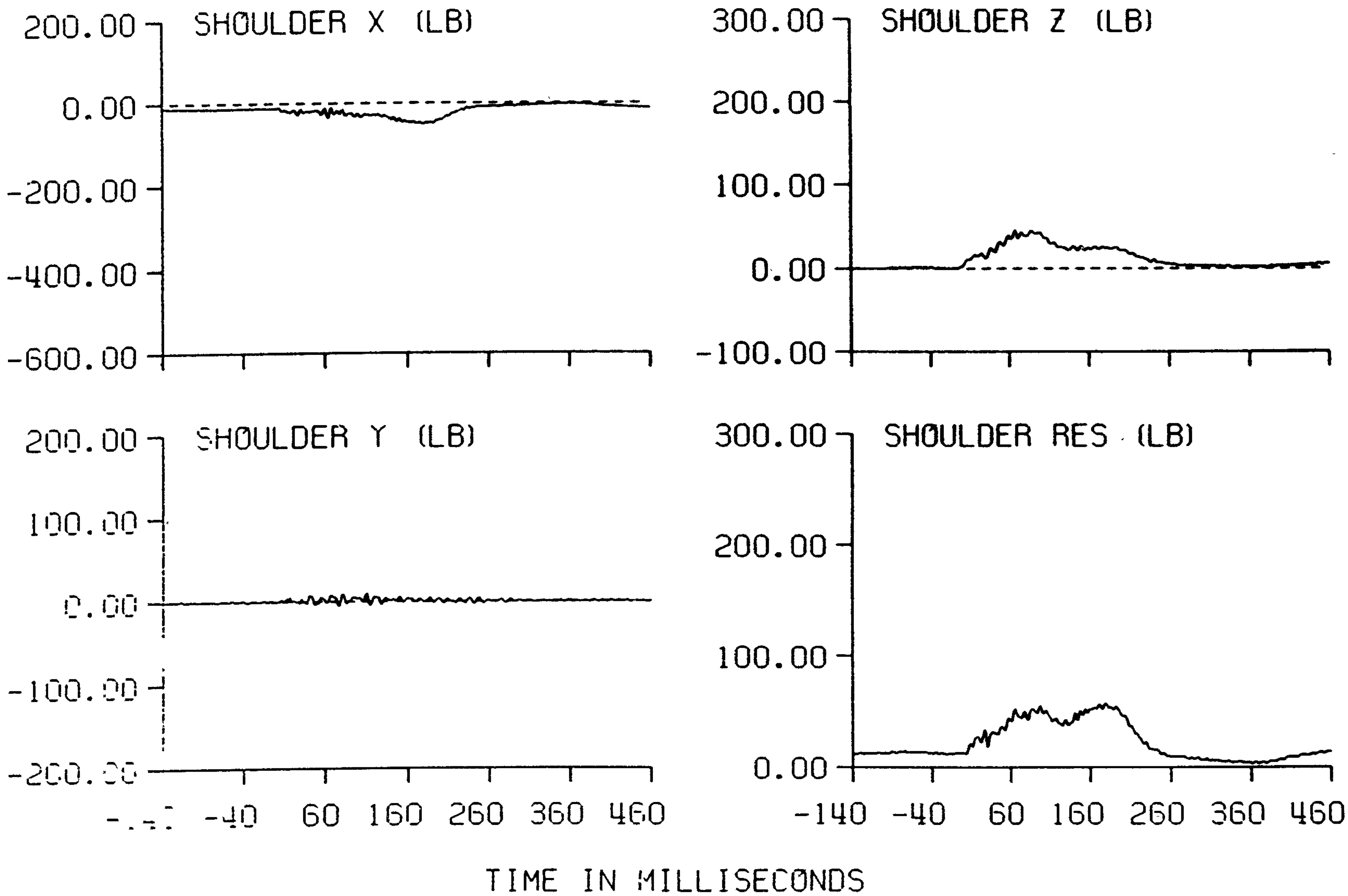


TIME IN MILLISECONDS

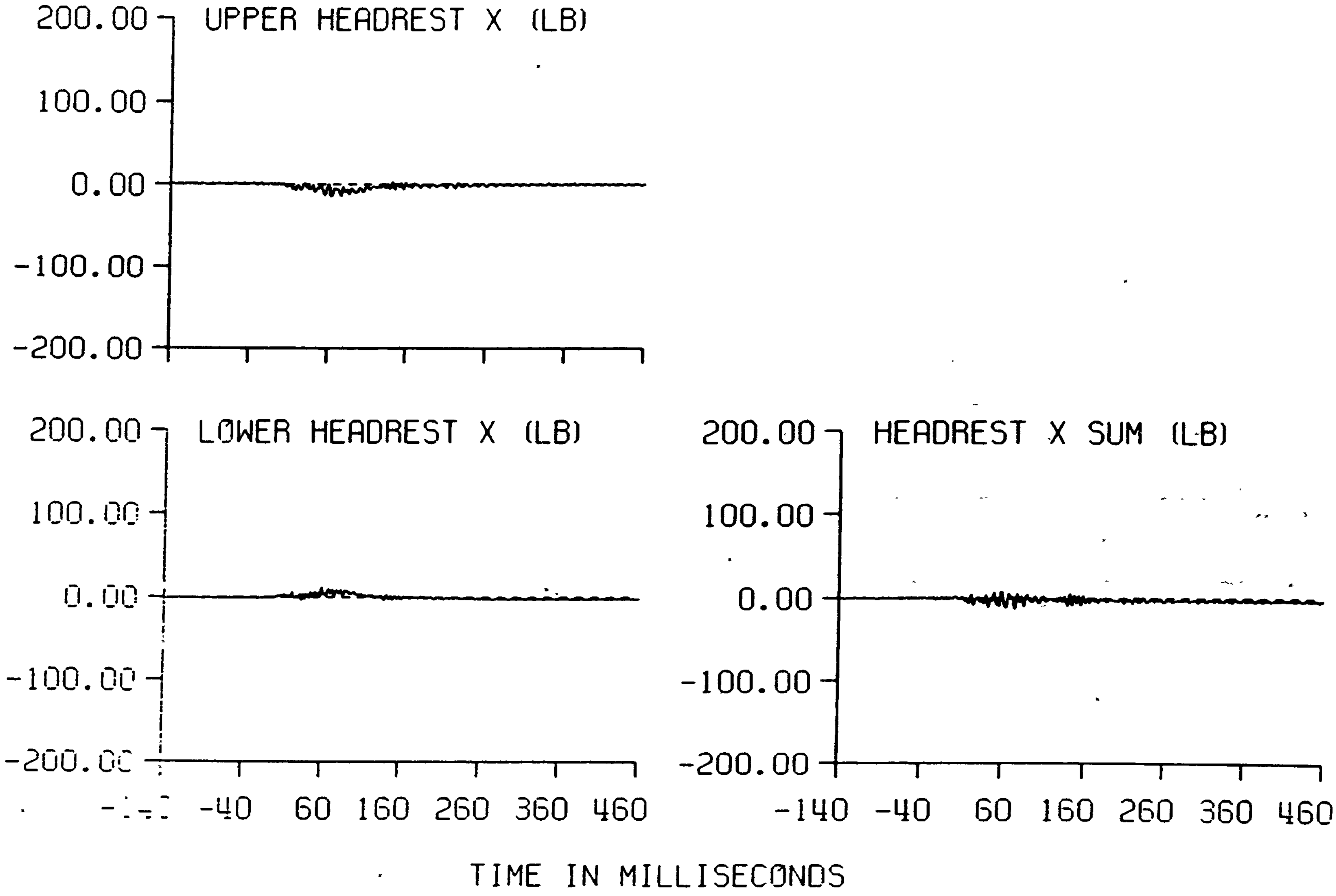
DP1 STUDY TEST: 1782 SUBJ: ADAM-L CELL: N1



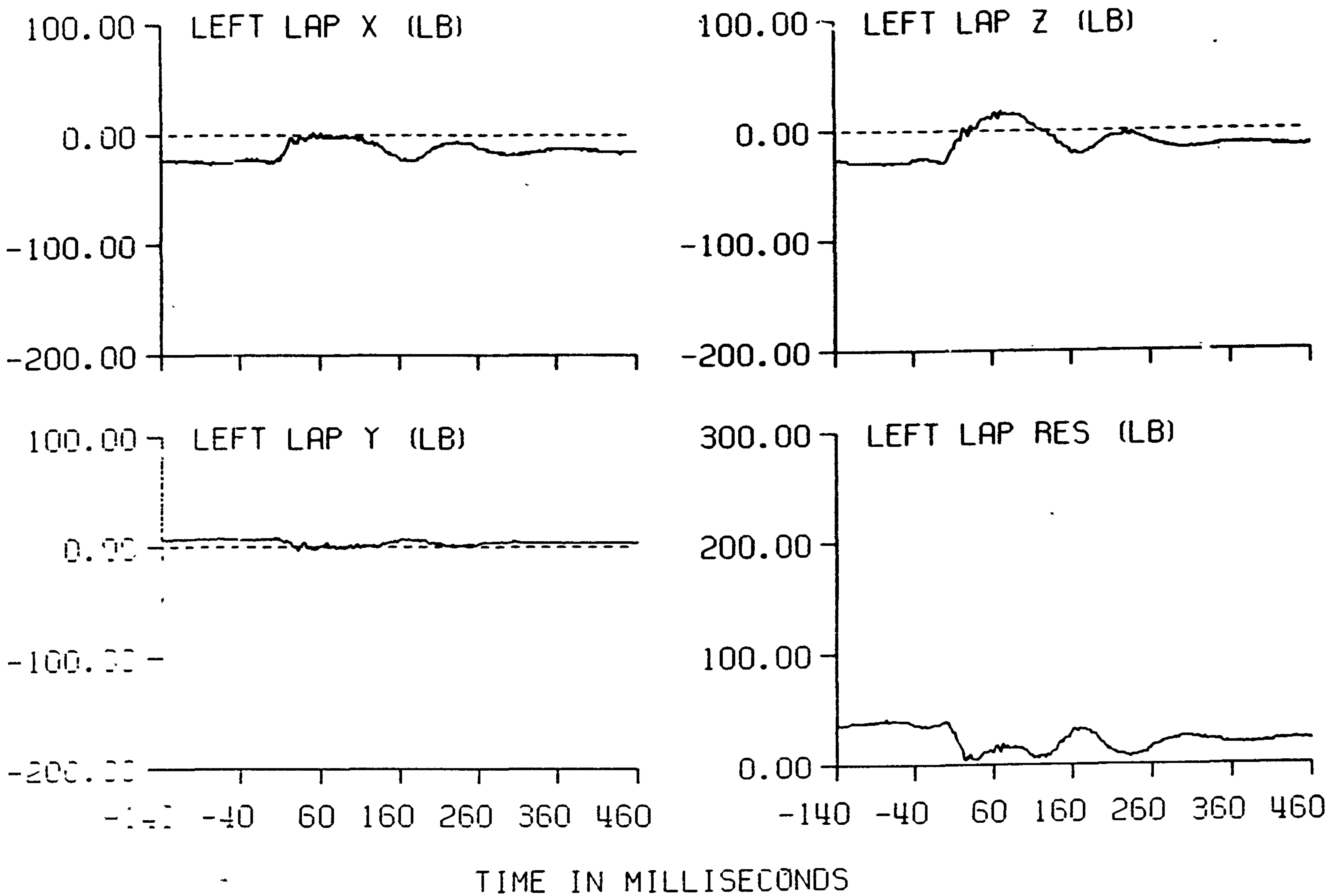
DP1 STUDY TEST: 1782 SUBJ: ADAM-L CELL: N1

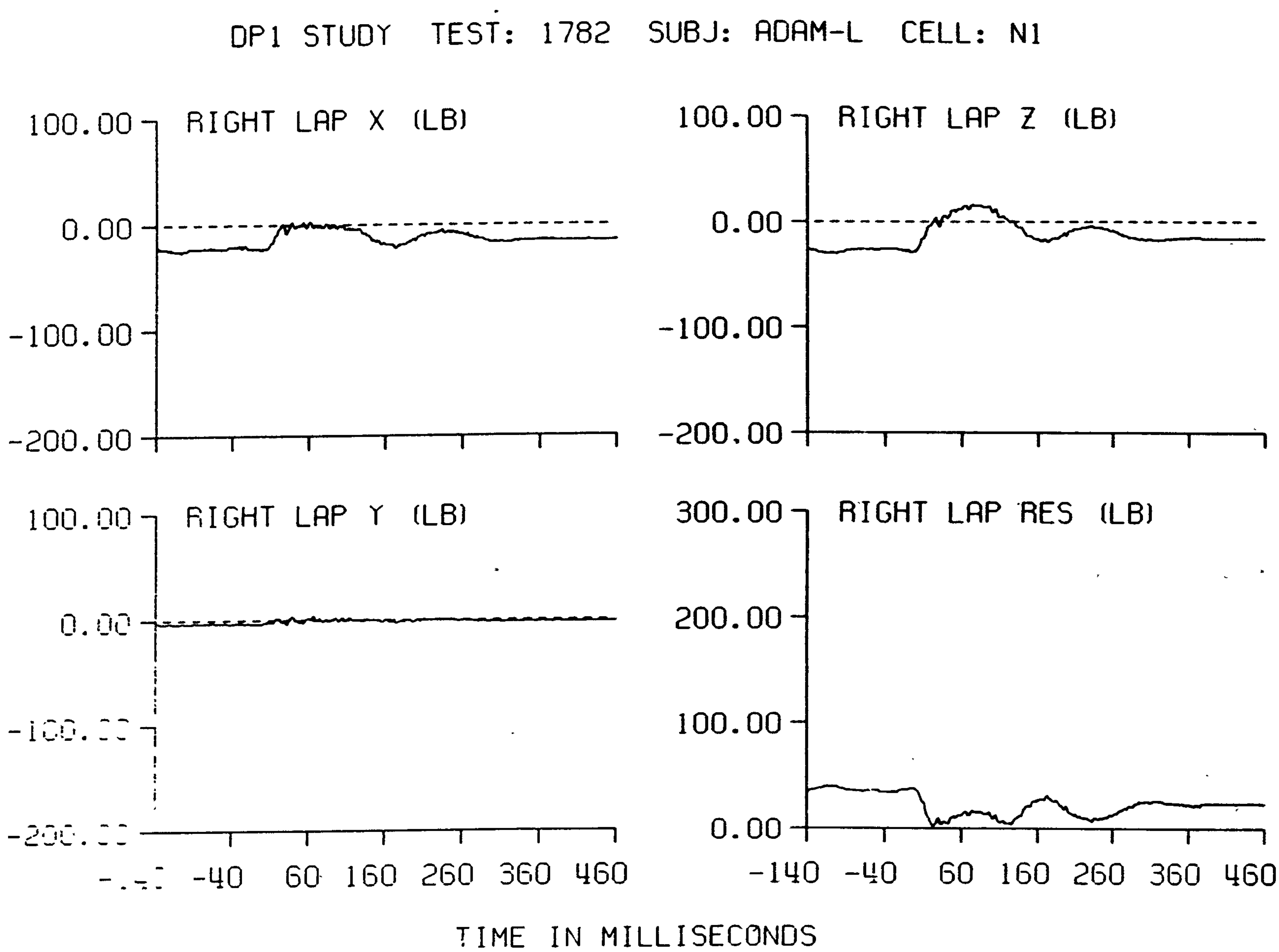


DP1 STUDY TEST: 1782 SUBJ: ADAM-L CELL: N1



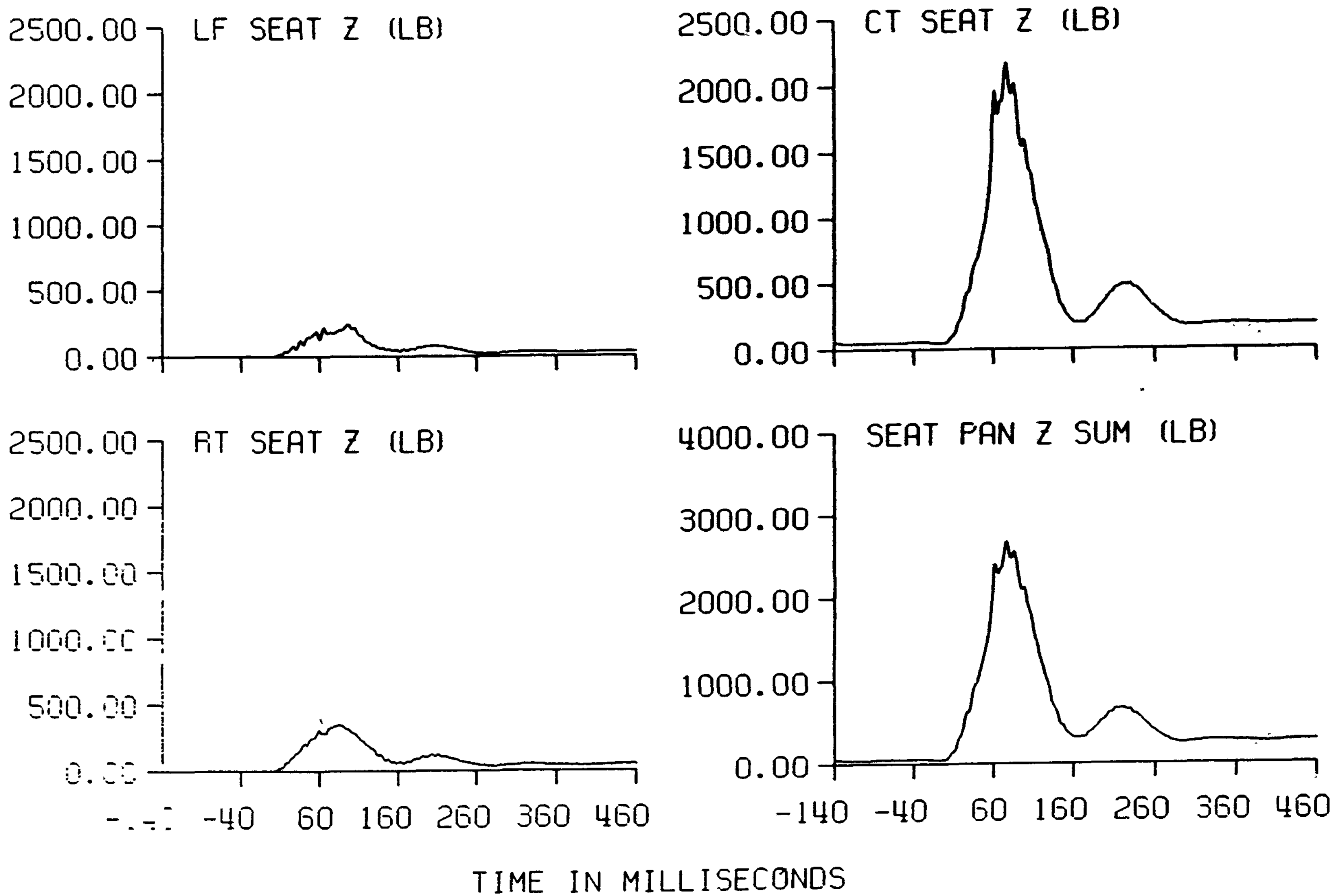
DP1 STUDY TEST: 1782 SUBJ: ADAM-L CELL: N1

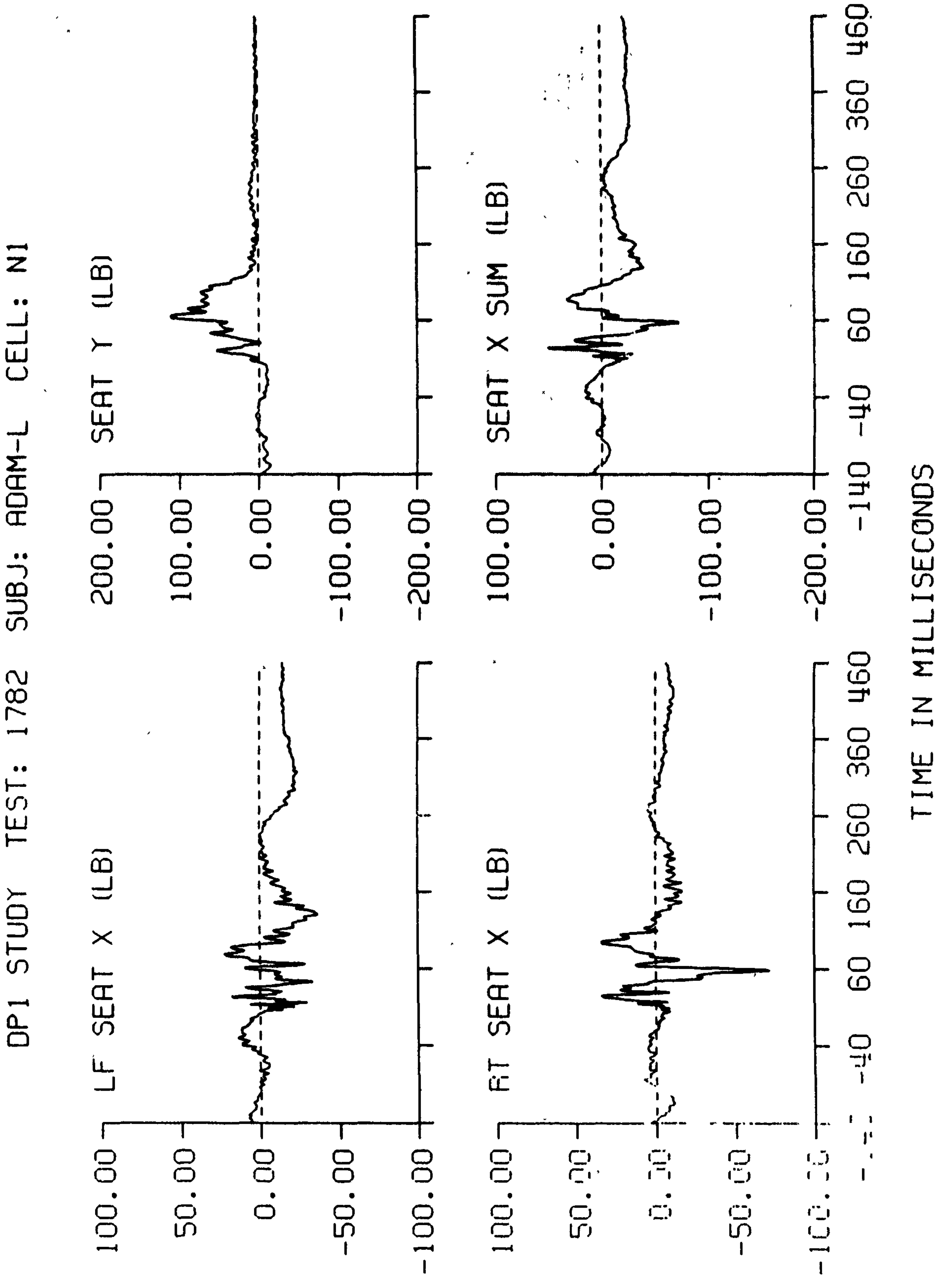




DP1 STUDY TEST: 1782 SUBJ: ADAM-L CELL: N1
RIGHT LAP X (LB)
100.00
0.00
-100.00
-200.00
RIGHT LAP Z (LB)
100.00
0.00
-100.00
-200.00
RIGHT LAP Y (LB)
100.00
0.00
-200.00
RIGHT LAP RES (LB)
300.00
200.00
100.00
0.00
-40 60 160 260 360 460
-140 -40 60 160 260 360 460
TIME IN MILLISECONDS

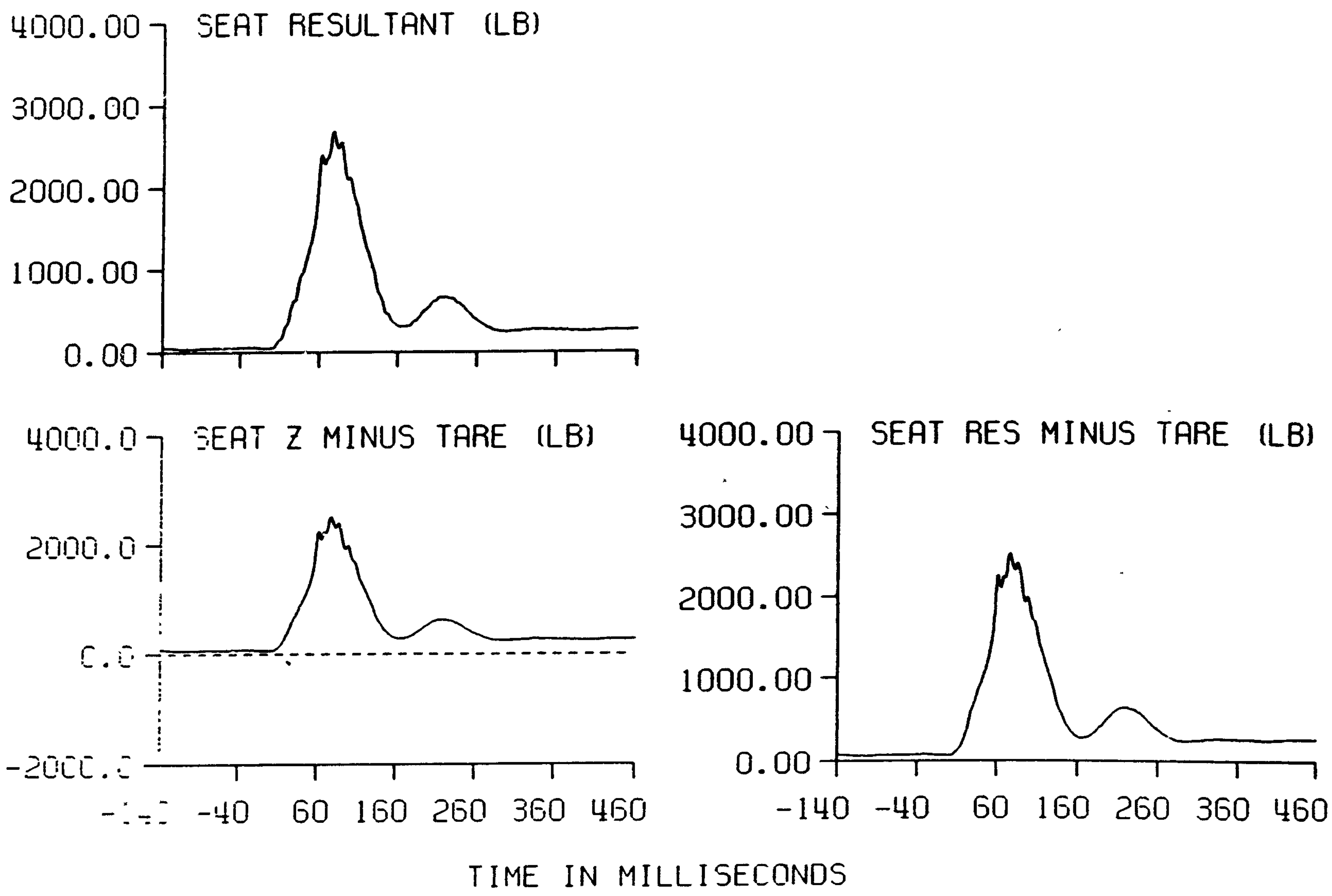
DP1 STUDY TEST: 1782 SUBJ: ADAM-L CELL: N1



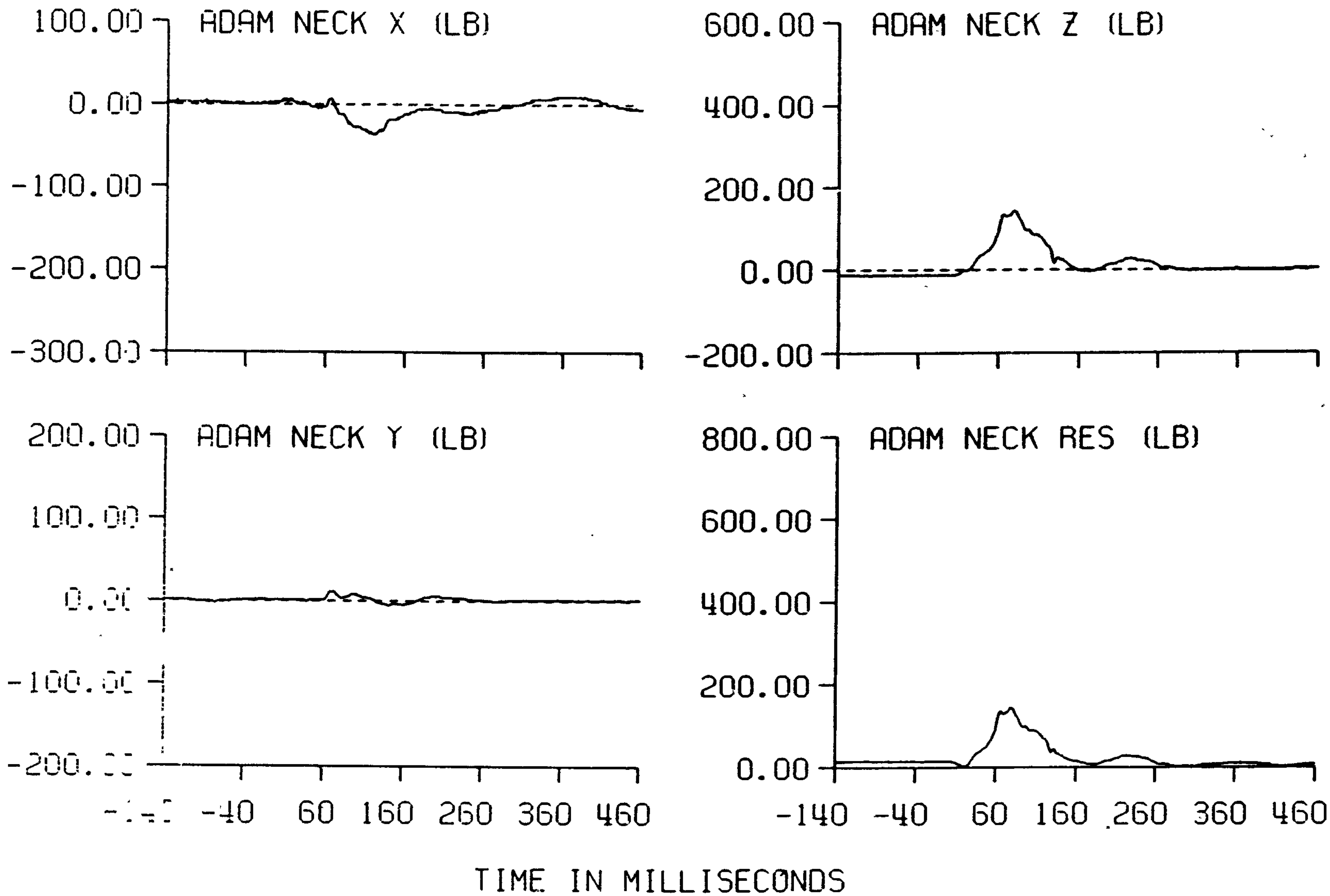


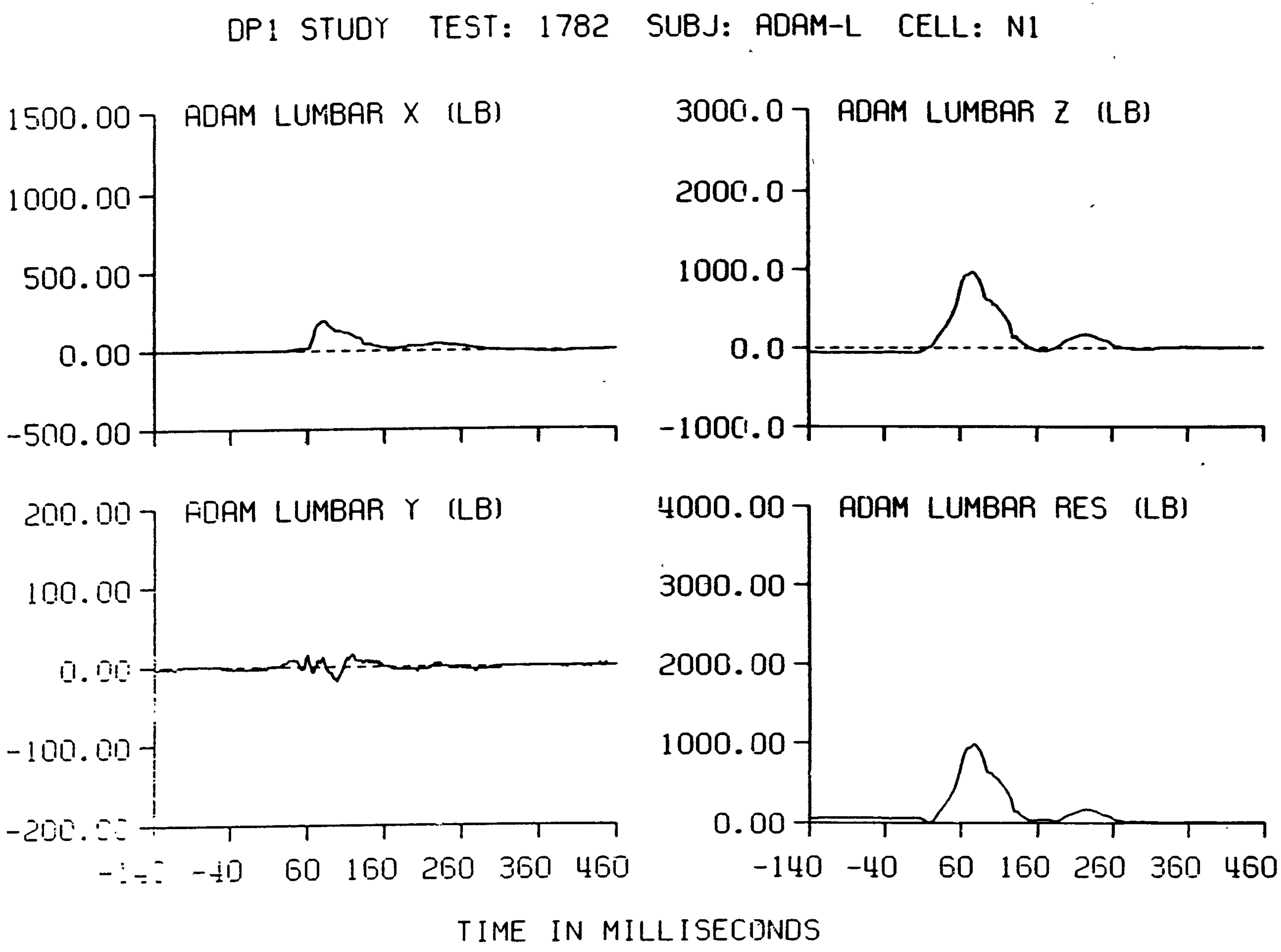
DP1 STUDY TEST: 1782 SUBJ: ADAM-L CELL: N1
LF SEAT X (LB)
SEAT Y (LB)
RT SEAT X (LB)
SEAT X SUM (LB)
100.00
50.00
0.00
-50.00
-100.00
200.00
100.00
0.00
-100.00
-200.00
-140 -40 60 160 260 360 460
TIME IN MILLISECONDS

DP1 STUDY TEST: 1782 SUBJ: ADAM-L CELL: N1

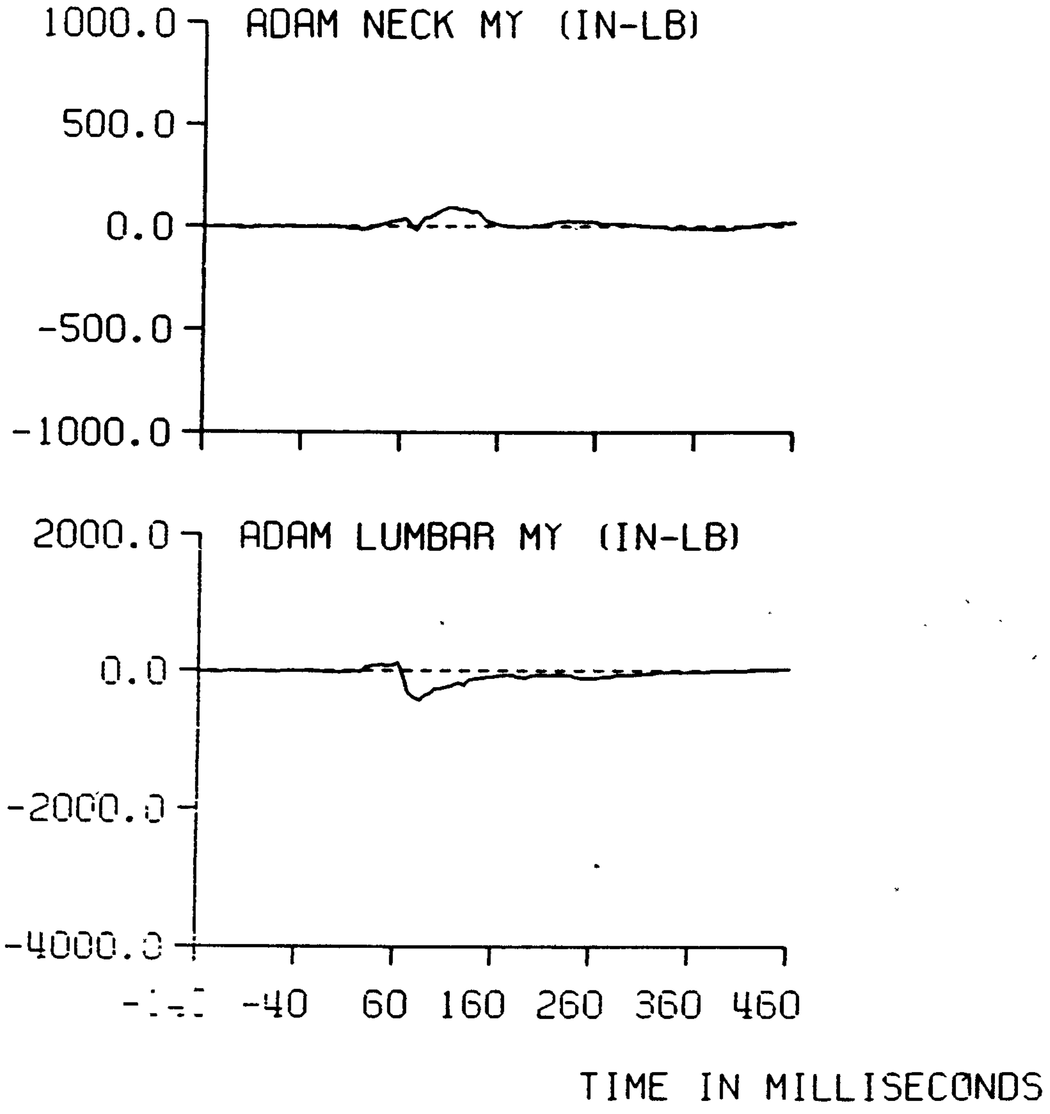


DP1 STUDY TEST: 1782 SUBJ: ADAM-L CELL: N1




DP1 STUDY TEST: 1782 SUBJ: ADAM-L CELL: N1
ADAM LUMBAR X (LB)
1500.00
1000.00
500.00
0.00
-500.00
ADAM LUMBAR Z (LB)
3000.0
2000.0
1000.0
0.0
-1000.0
ADAM LUMBAR Y (LB)
200.00
100.00
0.00
-100.00
ADAM LUMBAR RES (LB)
4000.00
3000.00
2000.00
1000.00
0.00
-140 -40 60 160 260 360 460
TIME IN MILLISECONDS

DP1 STUDY TEST: 1782 SUBJ: ADAM-L CELL: N1



DP1 STUDY TEST: 1783 SUBJ: ADAM-L WT: 218.0 NOM G: 8.0 CELL: M1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
REFERENCE MARK TIME (MS)				-135.	
2.5V EXT PWR (VOLTS)	2.50	2.50	2.50	155.	1.
10V EXT PWR (VOLTS)	10.00	10.00	10.00	107.	0.
CARRIAGE ACCELERATION (G)					
X AXIS	-0.01	2.36	-1.95	23.	58.
Y AXIS	-0.02	1.38	-1.16	15.	19.
Z AXIS	-0.01	9.47	0.33	73.	0.
Z AXIS PEAK 1		3.52		20.	
Z AXIS PEAK 2		9.47		73.	
CARRIAGE VELOCITY (FPS)	26.41	26.96	1.23	6.	354.
SEAT ACCELERATION (G)					
X AXIS	-0.04	2.05	-2.16	22.	57.
Y AXIS	0.01	2.12	-1.64	36.	29.
Z AXIS	-0.07	10.15	0.12	72.	0.
Z AXIS DRI	-0.02	11.62	-1.13	104.	174.
HEAD ACCELERATION (G)					
X AXIS	0.05	0.74	-3.32	63.	133.
Y AXIS	0.17	0.87	-0.27	98.	60.
Z AXIS	0.00	13.29	-0.14	80.	0.
RESULTANT	0.19	13.30	0.17	80.	1.
RY (RAD/SEC2)	-0.94	200.45	-209.44	74.	138.
CHEST ACCELERATION (G)					
X AXIS	-0.19	3.17	-1.25	77.	155.
Y AXIS	0.13	1.36	-0.37	63.	136.
Z AXIS	0.02	12.99	0.00	81.	0.
RESULTANT	0.24	13.22	0.25	82.	3.
RY (RAD/SEC2)	-0.56	419.44	-362.43	139.	131.
SHOULDER STRAP FORCES (LB)					
X AXIS	-15.53	-6.13	-55.21	265.	154.
Y AXIS	0.09	12.84	-7.08	67.	153.
Z AXIS	1.82	55.86	1.12	82.	306.
RESULTANT	15.66	68.09	6.59	79.	296.
HEADREST FORCES (LB)					
UPPER X AXIS	0.72	1.85	-12.86	239.	64.
LOWER X AXIS	-0.77	14.22	-4.43	60.	58.
X AXIS SUM	-0.05	12.36	-14.22	61.	58.

DP1 STUDY TEST: 1783 SUBJ: ADAM-L WT: 218.0 NOM G: 8.0 CELL: M1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
LAP FORCES (LB)					
LEFT X AXIS	-19.76	3.08	-24.71	52.	171.
LEFT Y AXIS	3.62	4.84	-3.34	2.	57.
LEFT Z AXIS	-26.61	18.11	-27.07	70.	0.
LEFT RESULTANT	33.35	35.42	2.02	173.	25.
RIGHT X AXIS	-23.18	2.64	-24.43	52.	0.
RIGHT Y AXIS	-6.72	1.60	-7.08	36.	0.
RIGHT Z AXIS	-30.13	14.13	-29.83	73.	0.
RIGHT RESULTANT	38.61	39.20	1.99	0.	35.
SEAT FORCES (LB)					
LEFT X AXIS	7.27	32.83	-26.60	55.	16.
RIGHT X AXIS	-1.61	55.02	-48.01	82.	56.
X AXIS SUM	5.67	56.02	-34.42	85.	11.
Y AXIS	-2.44	144.22	-3.73	74.	284.
LEFT Z AXIS	-2.83	307.63	-4.75	81.	0.
RIGHT Z AXIS	-0.81	276.29	-0.69	58.	0.
CENTER Z AXIS	56.95	2092.91	56.23	80.	0.
Z AXIS SUM	53.31	2608.35	50.79	80.	0.
RESULTANT	53.72	2612.43	50.85	80.	0.
Z SUM MINUS TARE	73.42	2446.62	66.01	82.	2.
RESULTANT MINUS TARE	73.67	2447.17	66.12	82.	2.
ADAM NECK FORCE (LB)					
X AXIS	0.74	11.46	-41.19	333.	114.
Y AXIS	1.52	9.78	-6.36	85.	160.
Z AXIS	-11.72	139.07	-14.17	78.	1.
RESULTANT	11.96	139.60	0.98	80.	23.
ADAM NECK MY (IN-LB)	-4.87	105.15	-36.31	118.	360.
ADAM LUMBAR FORCE (LB)					
X AXIS	-5.16	206.90	-7.30	81.	0.
Y AXIS	1.12	56.78	-14.40	58.	96.
Z AXIS	-65.69	928.31	-74.26	77.	0.
RESULTANT	66.01	949.40	1.56	78.	360.
ADAM LUMBAR MY (IN-LB)	71.80	131.30	-424.03	31.	82.

Page 2 of 2

DP1 STUDY TEST: 1784 SUBJ: ADAM-L WT: 218.0 NOM G: 8.0 CELL: L1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
REFERENCE MARK TIME (MS)				-130.	
2.5V EXT PWR (VOLTS)	2.50	2.50	2.50	14.	6.
10V EXT PWR (VOLTS)	10.00	10.00	10.00	183.	0.
CARRIAGE ACCELERATION (G)					
X AXIS	-0.01	1.61	-1.69	54.	59.
Y AXIS	0.06	0.79	-1.58	11.	55.
Z AXIS	0.02	9.32	0.36	74.	0.
CARRIAGE VELOCITY (FPS)	26.32	26.84	1.24	2.	341.
SEAT ACCELERATION (G)					
X AXIS	0.00	1.77	-1.71	63.	58.
Y AXIS	0.08	1.28	-1.49	70.	59.
Z AXIS	-0.05	10.35	0.13	80.	0.
Z AXIS DRI	-0.09	11.67	-1.16	106.	176.
HEAD ACCELERATION (G)					
X AXIS	0.10	0.56	-3.00	64.	134.
Y AXIS	0.03	1.18	-0.44	101.	62.
Z AXIS	-0.12	13.32	-0.11	84.	1.
RESULTANT	0.17	13.35	0.19	84.	0.
RY (RAD/SEC2)	-0.98	126.41	-210.76	77.	139.
CHEST ACCELERATION (G)					
X AXIS	-0.18	3.42	-0.94	85.	189.
Y AXIS	0.08	1.40	-0.06	65.	145.
Z AXIS	0.00	13.29	-0.04	83.	2.
RESULTANT	0.21	13.62	0.08	84.	3.
RY (RAD/SEC2)	1.85	317.54	-348.36	65.	88.
SHOULDER STRAP FORCES (LB)					
X AXIS	-16.27	-5.26	-46.15	265.	80.
Y AXIS	0.30	8.75	-2.17	75.	31.
Z AXIS	1.80	53.55	1.24	83.	277.
RESULTANT	16.39	67.35	5.66	81.	314.
HEADREST FORCES (LB)					
UPPER X AXIS	1.09	4.31	14.07	33.	58
LOWER X AXIS	-1.17	13.68	4.35	62.	36.
X AXIS SUM	-0.09	13.09	-13.47	62.	59.

DP1 STUDY TEST: 1784 SUBJ: ADAM-L WT: 218.0 NOM G: 8.0 CELL: L1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
LAP FORCES (LB)					
LEFT X AXIS	-21.35	4.70	-25.62	63.	164.
LEFT Y AXIS	2.81	4.11	-2.90	7.	56.
LEFT Z AXIS	-29.23	17.83	-29.30	67.	173.
LEFT RESULTANT	36.32	39.04	0.72	173.	35.
RIGHT X AXIS	-25.33	3.61	-25.26	54.	0.
RIGHT Y AXIS	-7.15	1.67	-7.02	70.	1.
RIGHT Z AXIS	-29.83	10.99	-29.83	59.	0.
RIGHT RESULTANT	39.78	39.71	3.94	1.	41.
SEAT FORCES (LB)					
LEFT X AXIS	-2.40	22.65	-29.64	14.	72.
RIGHT X AXIS	1.74	56.07	-36.66	76.	58.
X AXIS SUM	-0.66	33.91	-39.40	94.	51.
Y AXIS	6.91	159.02	-11.31	74.	148.
LEFT Z AXIS	-3.81	461.63	-3.81	81.	0.
RIGHT Z AXIS	-3.01	220.58	-3.49	59.	0.
CENTER Z AXIS	50.08	2111.28	55.85	82.	0.
Z AXIS SUM	43.26	2703.24	48.55	82.	0.
RESULTANT	43.89	2706.81	50.29	82.	0.
Z SUM MINUS TARE	62.94	2541.69	51.30	82.	4.
RESULTANT MINUS TARE	62.97	2541.78	52.87	82.	4.
ADAM NECK FORCE (LB)					
X AXIS	1.14	11.15	-38.40	337.	113.
Y AXIS	1.20	14.37	-3.39	100.	62.
Z AXIS	-11.97	144.16	-11.97	83.	0.
RESULTANT	12.17	145.23	1.31	84.	20.
ADAM NECK MY (IN-LB)	-2.52	91.79	-26.09	124.	350.
ADAM LUMBAR FORCE (LB)					
X AXIS	-8.73	181.67	-8.73	82.	0.
Y AXIS	-5.02	31.63	-55.36	58.	78.
Z AXIS	-62.75	976.95	-62.75	79.	0.
RESULTANT	63.58	994.65	4.61	82.	19.
ADAM LUMBAR MY (IN-LB)	82.14	122.57	-353.43	34.	84.

DP1 STUDY TEST: 1785 SUBJ: ADAM-L WT: 218.0 NOM G: 8.0 CELL: C1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
REFERENCE MARK TIME (MS)				-116.	
2.5V EXT PWR (VOLTS)	2.50	2.50	2.50	0.	3.
10V EXT PWR (VOLTS)	10.00	10.00	10.00	6.	0.
CARRIAGE ACCELERATION (G)					
X AXIS	0.03	1.53	-3.95	79.	22.
Y AXIS	-0.02	0.98	-0.89	12.	7.
Z AXIS	-0.04	9.09	0.43	89.	0.
CARRIAGE VELOCITY (FPS)	25.76	26.42	1.26	5.	360.
SEAT ACCELERATION (G)					
X AXIS	-0.16	1.37	-1.67	78.	73.
Y AXIS	0.09	2.03	-1.28	49.	42.
Z AXIS	-0.08	10.61	-0.45	92.	22.
Z AXIS DRI	-0.08	11.75	-1.25	121.	191.
HEAD ACCELERATION (G)					
X AXIS	0.01	1.26	-3.35	91.	146.
Y AXIS	0.12	0.92	-0.37	96.	79.
Z AXIS	-0.08	14.90	-0.12	100.	0.
RESULTANT	0.15	14.92	0.13	100.	3.
RY (RAD/SEC2)	-40.32	257.44	-271.45	100.	150.
CHEST ACCELERATION (G)					
X AXIS	-0.13	4.51	-0.86	100.	168.
Y AXIS	0.16	1.30	-0.21	80.	147.
Z AXIS	-0.08	16.16	-0.10	102.	0.
RESULTANT	0.23	16.58	0.17	102.	3.
RY (RAD/SEC2)	-5.56	981.49	-1367.87	114.	105.
SHOULDER STRAP FORCES (LB)					
X AXIS	-17.06	-6.36	-55.44	328.	180.
Y AXIS	-1.65	7.76	-5.73	83.	59.
Z AXIS	3.04	52.31	1.22	96.	323.
RESULTANT	17.42	66.94	7.36	94.	328.
HEADREST FORCES (LB)					
UPPER X AXIS	0.48	5.31	-13.69	40.	80.
LOWER X AXIS	-2.55	13.23	-4.18	76.	37.
X AXIS SUM	-2.08	13.56	-13.58	40.	37.

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DP1 STUDY TEST: 1785 SUBJ: ADAM-L WT: 218.0 NOM G: 8.0 CELL: C1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
LAP FORCES (LB)					
LEFT X AXIS	-26.88	1.21	-29.11	69.	179.
LEFT Y AXIS	4.06	4.56	-4.79	0.	99.
LEFT Z AXIS	-31.82	17.28	-31.82	88.	0.
LEFT RESULTANT	41.87	41.71	4.07	0.	55.
RIGHT X AXIS	-27.75	1.26	-27.61	69.	0.
RIGHT Y AXIS	-7.95	-0.04	-7.85	48.	0.
RIGHT Z AXIS	-34.36	14.66	-32.43	78.	0.
RIGHT RESULTANT	44.88	43.31	6.04	0.	48.
SEAT FORCES (LB)					
LEFT X AXIS	-6.15	21.32	-53.56	75.	98.
RIGHT X AXIS	-2.74	48.38	-44.35	92.	74.
X AXIS SUM	-8.89	19.87	-73.43	91.	144.
Y AXIS	2.55	144.05	-17.58	92.	14.
LEFT Z AXIS	-5.22	373.35	-7.75	101.	1.
RIGHT Z AXIS	3.71	245.85	3.11	78.	0.
CENTER Z AXIS	50.22	2161.63	49.98	95.	0.
Z AXIS SUM	48.70	2730.96	48.47	103.	0.
RESULTANT	49.62	2733.17	49.35	103.	0.
Z SUM MINUS TARE	69.01	2581.01	61.60	103.	1.
RESULTANT MINUS TARE	69.59	2581.30	61.98	103.	1.
ADAM NECK FORCE (LB)					
X AXIS	-2.73	9.54	-40.01	345.	126.
Y AXIS	0.21	11.21	-4.94	94.	166.
Z AXIS	-17.90	153.24	-20.24	100.	3.
RESULTANT	18.13	153.92	2.85	100.	28.
ADAM NECK MY (IN-LB)	-8.96	93.20	-32.53	133.	353.
ADAM LUMBAR FORCE (LB)					
X AXIS	-13.95	216.42	-21.58	100.	74.
Y AXIS	0.15	47.45	-39.54	77.	95.
Z AXIS	-61.06	1048.98	-64.99	96.	2.
RESULTANT	62.66	1064.50	4.54	97.	296.
ADAM LUMBAR MY (IN-LB)	24.40	118.99	-515.68	60.	100.

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DP1 STUDY TEST: 1786 SUBJ: ADAM-L WT: 218.0 NOM G: 8.0 CELL: C1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
REFERENCE MARK TIME (MS)				-82.	
2.5V EXT PWR (VOLTS)	2.50	2.50	2.50	31.	40.
10V EXT PWR (VOLTS)	10.00	10.00	10.00	0.	1.
CARRIAGE ACCELERATION (G)					
X AXIS	0.02	4.62	-5.29	20.	25.
Y AXIS	-0.05	2.88	-9.23	18.	27.
Z AXIS	-0.01	7.20	-30.94	101.	18.
Z AXIS PEAK 1		7.08		6.	
Z AXIS PEAK 2		7.20		101.	
CARRIAGE VELOCITY (FPS)	24.80	25.47	1.26	2.	388.
SEAT ACCELERATION (G)					
X AXIS	-0.07	2.41	-2.12	39.	83.
Y AXIS	0.03	3.69	-2.75	31.	14.
Z AXIS	-0.08	10.89	-4.20	7.	25.
Z AXIS DRI	-0.11	9.54	-0.67	139.	209.
HEAD ACCELERATION (G)					
X AXIS	-0.26	0.21	-2.40	33.	159.
Y AXIS	0.05	0.58	-0.19	113.	53.
Z AXIS	-0.07	13.76	-0.23	121.	70.
RESULTANT	0.28	13.80	0.15	121.	2.
RY (RAD/SEC2)	-19.64	209.97	-180.09	123.	165.
CHEST ACCELERATION (G)					
X AXIS	-0.38	3.24	-2.57	127.	19.
Y AXIS	0.18	1.25	-0.40	129.	76.
Z AXIS	0.09	14.61	-0.56	123.	15.
RESULTANT	0.43	14.88	0.24	124.	5.
RY (RAD/SEC2)	-3.36	917.07	-837.47	136.	10.
SHOULDER STRAP FORCES (LB)					
X AXIS	-15.53	-5.11	-40.90	47.	9.
Y AXIS	0.20	10.88	-7.12	107.	42.
Z AXIS	2.27	40.27	1.34	108.	0.
RESULTANT	15.71	50.70	6.31	106.	369.
HEADREST FORCES (LB)					
UPPER X AXIS	0.71	7.35	-18.38	44.	7.
LOWER X AXIS	-0.97	11.85	-6.80	86.	30.
X AXIS SUM	-0.26	13.07	-16.48	86.	7.

DP1 STUDY TEST: 1786 SUBJ: ADAM-L WT: 218.0 NOM G: 8.0 CELL: C1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
REFERENCE MARK TIME (MS)				-82.	
2.5V EXT PWR (VOLTS)	2.50	2.50	2.50	31.	40.
10V EXT PWR (VOLTS)	10.00	10.00	10.00	0.	1.
CARRIAGE ACCELERATION (G)					
X AXIS	0.02	4.62	-5.29	20.	25.
Y AXIS	-0.05	2.88	-9.23	18.	27.
Z AXIS	-0.01	7.20	-30.94	101.	18.
Z AXIS PEAK 1		7.08		6.	
Z AXIS PEAK 2		7.20		101.	
CARRIAGE VELOCITY (FPS)	24.80	25.47	1.26	2.	388.
SEAT ACCELERATION (G)					
X AXIS	-0.07	2.41	-2.12	39.	83.
Y AXIS	0.03	3.69	-2.75	31.	14.
Z AXIS	-0.08	10.89	-4.20	7.	25.
Z AXIS DRI	-0.11	9.54	-0.67	139.	209.
HEAD ACCELERATION (G)					
X AXIS	-0.26	0.21	-2.40	33.	159.
Y AXIS	0.05	0.58	-0.19	113.	53.
Z AXIS	-0.07	13.76	-0.23	121.	70.
RESULTANT	0.28	13.80	0.15	121.	2.
RY (RAD/SEC2)	-19.64	209.97	-180.09	123.	165.
CHEST ACCELERATION (G)					
X AXIS	-0.38	3.24	-2.57	127.	19.
Y AXIS	0.18	1.25	-0.40	129.	76.
Z AXIS	0.09	14.61	-0.56	123.	15.
RESULTANT	0.43	14.88	0.24	124.	5.
RY (RAD/SEC2)	-3.36	917.07	-837.47	136.	10.
SHOULDER STRAP FORCES (LB)					
X AXIS	-15.53	-5.11	-40.90	47.	9.
Y AXIS	0.20	10.88	-7.12	107.	42.
Z AXIS	2.27	40.27	1.34	108.	0.
RESULTANT	15.71	50.70	6.31	106.	369.
HEADREST FORCES (LB)					
UPPER X AXIS	0.71	7.35	-18.38	44.	7.
LOWER X AXIS	-0.97	11.85	-6.80	86.	30.
X AXIS SUM	-0.26	13.07	-16.48	86.	7.

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DP1 STUDY TEST: 1786 SUBJ: ADAM-L WT: 218.0 NOM G: 8.0 CELL: C1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
LAP FORCES (LB)					
LEFT X AXIS	-25.37	2.53	-25.27	100.	0.
LEFT Y AXIS	7.51	8.27	-3.41	3.	105.
LEFT Z AXIS	-31.69	13.79	-31.39	99.	0.
LEFT RESULTANT	41.29	40.92	4.04	0.	78.
RIGHT X AXIS	-26.10	1.80	-27.07	79.	0.
RIGHT Y AXIS	-4.54	5.18	-4.38	32.	0.
RIGHT Z AXIS	-32.59	12.94	-32.59	100.	0.
RIGHT RESULTANT	42.00	42.59	2.80	0.	22.
SEAT FORCES (LB)					
LEFT X AXIS	-9.22	53.23	-79.90	102.	44.
RIGHT X AXIS	3.62	47.21	-71.85	79.	49.
X AXIS SUM	-5.60	70.77	-150.60	80.	44.
Y AXIS	-0.62	77.08	-37.30	118.	19.
LEFT Z AXIS	-1.87	266.77	-1.87	120.	0.
RIGHT Z AXIS	1.68	314.32	0.00	125.	0.
CENTER Z AXIS	54.78	1880.25	55.98	117.	0.
Z AXIS SUM	54.58	2427.08	54.11	118.	0.
RESULTANT	54.88	2428.42	54.25	118.	1.
Z SUM MINUS TARE	74.83	2295.86	57.35	117.	3.
RESULTANT MINUS TARE	75.05	2296.05	57.56	117.	3.
ADAM NECK FORCE (LB)					
X AXIS	-2.74	3.10	-27.87	362.	127.
Y AXIS	-0.22	7.17	-2.52	112.	53.
Z AXIS	-13.08	141.39	-17.64	120.	69.
RESULTANT	13.43	143.22	0.77	122.	13.
ADAM NECK MY (IN-LB)	0.79	67.58	-18.86	135.	18.
ADAM LUMBAR FORCE (LB)					
X AXIS	2.14	190.40	0.00	122.	0.
Y AXIS	-5.18	3.80	-31.79	48.	112.
Z AXIS	-93.93	918.28	-93.58	116.	0.
RESULTANT	94.18	927.43	12.36	117.	14.
ADAM LUMBAR MY (IN-LB)	55.34	159.85	-355.82	32.	122.

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DP1 STUDY TEST: 1787 SUBJ: ADAM-L WT: 218.0 NOM G: 8.0 CELL: C1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
REFERENCE MARK TIME (MS)				-95.	
2.5V EXT PWR (VOLTS)	2.50	2.50	2.50	58.	5.
10V EXT PWR (VOLTS)	10.00	10.00	10.00	0.	2.
CARRIAGE ACCELERATION (G)					
X AXIS	-0.01	2.90	-4.15	43.	17.
Y AXIS	-0.02	1.19	-11.51	31.	17.
Z AXIS	0.03	8.15	-0.39	97.	24.
Z AXIS PEAK 1		7.19		19.	
Z AXIS PEAK 2		8.15		97.	
CARRIAGE VELOCITY (FPS)	25.24	25.92	1.26	2.	373.
SEAT ACCELERATION (G)					
X AXIS	-0.05	2.86	-2.02	24.	47.
Y AXIS	0.02	4.49	-2.57	30.	94.
Z AXIS	-0.07	9.09	-4.17	107.	24.
Z AXIS DRI	-0.08	10.49	-0.87	130.	199.
HEAD ACCELERATION (G)					
X AXIS	-0.23	0.27	-2.23	98.	153.
Y AXIS	0.12	0.81	-0.22	114.	55.
Z AXIS	-0.13	13.41	-0.20	112.	0.
RESULTANT	0.29	13.45	0.19	113.	7.
RY (RAD/SEC2)	-12.02	130.37	-153.91	111.	159.
CHEST ACCELERATION (G)					
X AXIS	-0.36	3.42	-1.41	116.	9.
Y AXIS	0.24	0.91	-0.34	46.	68.
Z AXIS	0.04	13.32	-0.34	114.	15.
RESULTANT	0.44	13.68	0.06	114.	17.
RY (RAD/SEC2)	-1.56	873.98	-858.11	125.	119.
SHOULDER STRAP FORCES (LB)					
X AXIS	-16.32	-7.16	-40.90	303.	100.
Y AXIS	0.10	14.17	-10.26	87.	19.
Z AXIS	3.41	49.83	3.60	102.	0.
RESULTANT	16.68	62.62	8.12	100.	305.
HEADREST FORCES (LB)					
UPPER X AXIS	0.93	5.83	-12.55	203.	90.
LOWER X AXIS	-1.11	12.42	-4.36	82.	39.
X AXIS SUM	-0.18	12.13	-10.79	82.	39.

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DP1 STUDY TEST: 1787 SUBJ: ADAM-L WT: 218.0 NOM G: 8.0 CELL: C1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
LAP FORCES (LB)					
LEFT X AXIS	-25.17	0.10	-25.17	73.	0.
LEFT Y AXIS	5.19	5.82	-5.87	0.	69.
LEFT Z AXIS	-31.31	15.75	-31.39	94.	0.
LEFT RESULTANT	40.51	40.65	5.31	0.	21.
RIGHT X AXIS	-21.83	3.43	-21.83	84.	0.
RIGHT Y AXIS	-6.66	4.39	-6.02	82.	0.
RIGHT Z AXIS	-29.35	14.66	-29.29	89.	0.
RIGHT RESULTANT	37.19	37.03	1.08	0.	56.
SEAT FORCES (LB)					
LEFT X AXIS	-6.37	48.45	-70.41	93.	57.
RIGHT X AXIS	8.96	28.55	-45.86	88.	48.
X AXIS SUM	2.59	58.64	-103.33	94.	49.
Y AXIS	1.34	111.90	-31.08	106.	15.
LEFT Z AXIS	-4.44	376.54	-4.56	118.	0.
RIGHT Z AXIS	-2.29	198.68	-3.61	116.	0.
CENTER Z AXIS	46.52	1918.61	44.36	106.	0.
Z AXIS SUM	39.79	2428.39	36.19	106.	0.
RESULTANT	40.07	2431.12	36.65	106.	0.
Z SUM MINUS TARE	59.86	2289.64	29.49	110.	5.
RESULTANT MINUS TARE	60.03	2289.86	36.15	110.	5.
ADAM NECK FORCE (LB)					
X AXIS	-0.74	5.45	-25.52	13.	136.
Y AXIS	1.61	11.17	-1.74	110.	57.
Z AXIS	-12.90	138.79	-14.46	110.	0.
RESULTANT	13.05	140.18	1.66	114.	310.
ADAM NECK MY (IN-LB)	4.38	62.71	-15.87	126.	339.
ADAM LUMBAR FORCE (LB)					
X AXIS	-4.14	154.23	-4.44	112.	0.
Y AXIS	-0.15	15.81	-23.73	52.	123.
Z AXIS	-83.73	928.12	-93.01	107.	0.
RESULTANT	83.85	938.51	3.50	110.	18.
ADAM LUMBAR MY (IN-LB)	69.01	158.26	-278.07	38.	114.

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DP1 STUDY TEST: 1788 SUBJ: ADAM-L WT: 218.0 NOM G: 8.0 CELL: D1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
REFERENCE MARK TIME (MS)				-94.	
2.5V EXT PWR (VOLTS)	2.50	2.50	2.50	78.	15.
10V EXT PWR (VOLTS)	10.00	10.00	10.00	2.	0.
CARRIAGE ACCELERATION (G)					
X AXIS	0.00	2.46	-4.03	16.	25.
Y AXIS	0.00	3.22	-12.05	30.	16.
Z AXIS	-0.01	7.44	-23.18	102.	22.
Z AXIS PEAK 1		7.20		5.	
Z AXIS PEAK 2		7.44		102.	
CARRIAGE VELOCITY (FPS)	25.16	25.84	1.22	1.	443.
SEAT ACCELERATION (G)					
X AXIS	-0.01	4.39	-1.43	20.	12.
Y AXIS	0.02	2.92	-2.95	31.	14.
Z AXIS	-0.08	11.62	-4.67	7.	25.
Z AXIS DRI	-0.10	9.60	-0.69	136.	205.
HEAD ACCELERATION (G)					
X AXIS	-0.06	0.44	-2.44	34.	156.
Y AXIS	0.05	0.67	-0.39	137.	86.
Z AXIS	-0.11	13.12	-0.12	118.	0.
RESULTANT	0.14	13.16	0.11	118.	5.
RY (RAD/SEC2)	-7.08	235.75	-227.03	120.	162.
CHEST ACCELERATION (G)					
X AXIS	-0.24	3.48	-2.14	124.	18.
Y AXIS	0.10	0.98	-0.52	36.	18.
Z AXIS	-0.01	13.98	-1.10	119.	15.
RESULTANT	0.26	14.30	0.19	120.	4.
RY (RAD/SEC2)	-0.88	888.04	-829.08	133.	124.
SHOULDER STRAP FORCES (LB)					
X AXIS	-14.04	-2.99	-40.82	27.	9.
Y AXIS	1.40	9.81	-6.26	24.	41.
Z AXIS	1.73	44.35	0.56	106.	389.
RESULTANT	14.21	56.94	4.85	102.	27.
HEADREST FORCES (LB)					
UPPER X AXIS	0.73	7.10	-18.03	26.	7.
LOWER X AXIS	0.64	11.14	-7.51	15.	30.
X AXIS SUM	1.38	12.02	-16.83	26.	7.

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DP1 STUDY TEST: 1788 SUBJ: ADAM-L WT: 218.0 NOM G: 8.0 CELL: D1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
LAP FORCES (LB)					
LEFT X AXIS	-25.02	0.25	-25.02	86.	0.
LEFT Y AXIS	7.73	9.25	-2.43	1.	42.
LEFT Z AXIS	-29.16	13.75	-29.46	103.	0.
LEFT RESULTANT	39.20	39.49	4.92	0.	145.
RIGHT X AXIS	-22.73	1.77	-21.69	85.	0.
RIGHT Y AXIS	-4.44	4.34	-4.34	32.	0.
RIGHT Z AXIS	-29.77	12.43	-28.38	18.	0.
RIGHT RESULTANT	37.73	35.98	0.88	0.	22.
SEAT FORCES (LB)					
LEFT X AXIS	-8.00	37.99	-92.76	98.	50.
RIGHT X AXIS	-5.59	25.14	-79.04	80.	46.
X AXIS SUM	-13.60	27.73	-150.67	12.	45.
Y AXIS	1.48	92.00	-31.08	112.	28.
LEFT Z AXIS	-1.01	270.64	-1.13	116.	0.
RIGHT Z AXIS	5.38	320.42	6.10	125.	0.
CENTER Z AXIS	46.88	1843.51	50.48	113.	0.
Z AXIS SUM	51.25	2384.72	55.46	114.	0.
RESULTANT	53.07	2386.84	57.24	113.	0.
Z SUM MINUS TARE	71.46	2261.76	58.27	113.	2.
RESULTANT MINUS TARE	72.75	2262.14	58.53	113.	3.
ADAM NECK FORCE (LB)					
X AXIS	-0.25	5.82	-31.34	373.	146.
Y AXIS	0.20	9.95	-6.20	121.	184.
Z AXIS	-13.99	139.25	-13.99	117.	0.
RESULTANT	14.01	140.31	0.65	118.	16.
ADAM NECK MY (IN-LB)	0.15	86.29	-15.87	134.	14.
ADAM LUMBAR FORCE (LB)					
X AXIS	-5.09	185.00	-13.33	120.	24.
Y AXIS	-4.79	7.99	-27.60	97.	109.
Z AXIS	-78.32	920.32	-82.25	113.	3.
RESULTANT	78.67	925.10	4.81	113.	14.
ADAM LUMBAR MY (IN-LB)	76.96	215.79	-339.54	30.	122.

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DP1 STUDY TEST: 1789 SUBJ: ADAM-L WT: 218.0 NOM G: 8.0 CELL: D1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
LAP FORCES (LB)					
LEFT X AXIS	-27.05	2.98	-24.82	78.	0.
LEFT Y AXIS	9.19	9.28	-2.41	0.	72.
LEFT Z AXIS	-31.43	15.71	-29.46	81.	0.
LEFT RESULTANT	42.48	39.62	4.60	0.	58.
RIGHT X AXIS	-24.04	1.99	-25.08	77.	1.
RIGHT Y AXIS	-3.81	2.43	-3.65	78.	0.
RIGHT Z AXIS	-30.10	15.67	-28.29	96.	0.
RIGHT RESULTANT	38.72	37.98	3.25	1.	31.
SEAT FORCES (LB)					
LEFT X AXIS	-7.55	21.75	-46.00	103.	36.
RIGHT X AXIS	-0.24	22.39	-42.86	31.	103.
X AXIS SUM	-7.79	21.56	-68.25	31.	36.
Y AXIS	-0.91	90.76	-4.97	84.	295.
LEFT Z AXIS	-1.51	262.33	-3.19	111.	1.
RIGHT Z AXIS	-0.74	329.26	-0.62	104.	0.
CENTER Z AXIS	48.93	2103.16	53.98	96.	0.
Z AXIS SUM	46.68	2641.80	53.29	96.	0.
RESULTANT	47.36	2643.32	53.97	96.	0.
Z SUM MINUS TARE	66.55	2481.45	62.59	97.	2.
RESULTANT MINUS TARE	67.01	2481.50	62.89	97.	2.
ADAM NECK FORCE (LB)					
X AXIS	0.78	9.35	-34.00	88.	131.
Y AXIS	1.27	9.53	-3.39	88.	160.
Z AXIS	-12.98	158.39	-12.20	100.	0.
RESULTANT	13.14	158.73	0.66	102.	304.
ADAM NECK MY (IN-LB)	-5.19	81.26	-36.62	134.	98.
ADAM LUMBAR FORCE (LB)					
X AXIS	-7.94	190.40	-15.87	102.	82.
Y AXIS	-0.84	11.94	-15.74	98.	87.
Z AXIS	-46.96	1020.95	-46.60	99.	0.
RESULTANT	47.66	1034.52	7.94	99.	15.
ADAM LUMBAR MY (IN-LB)	3.80	158.66	-436.34	82.	102.

DP1 STUDY TEST: 1790 SUBJ: ADAM-L WT: 218.0 NOM G: 8.0 CELL: C1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
REFERENCE MARK TIME (MS)				-87.	
2.5V EXT PWR (VOLTS)	2.50	2.50	2.50	7.	21.
10V EXT PWR (VOLTS)	10.00	10.00	10.00	0.	3.
CARRIAGE ACCELERATION (G)					
X AXIS	0.05	3.46	-4.92	40.	17.
Y AXIS	0.01	5.02	-6.11	11.	20.
Z AXIS	-0.02	7.20	-13.19	101.	18.
Z AXIS PEAK 1		7.14		6.	
Z AXIS PEAK 2		7.20		101.	
CARRIAGE VELOCITY (FPS)	24.85	25.48	1.26	0.	377.
SEAT ACCELERATION (G)					
X AXIS	0.03	2.55	-4.37	39.	17.
Y AXIS	-0.10	4.12	-4.58	31.	45.
Z AXIS	-0.04	11.21	-5.23	7.	25.
Z AXIS DRI	-0.11	9.53	-0.67	139.	208.
HEAD ACCELERATION (G)					
X AXIS	0.03	0.81	-2.37	31.	158.
Y AXIS	0.06	0.82	-0.65	37.	30.
Z AXIS	-0.12	13.64	-0.44	121.	70.
RESULTANT	0.14	13.66	0.13	121.	0.
RY (RAD/SEC2)	-2.79	185.11	-178.50	124.	164.
CHEST ACCELERATION (G)					
X AXIS	-0.18	3.51	-1.48	122.	65.
Y AXIS	0.16	1.29	-1.08	50.	72.
Z AXIS	-0.03	14.62	-0.63	124.	16.
RESULTANT	0.25	15.00	0.17	124.	4.
RY (RAD/SEC2)	-1.31	1372.66	-1463.04	49.	128.
SHOULDER STRAP FORCES (LB)					
X AXIS	-12.27	2.09	-42.90	47.	206.
Y AXIS	0.15	12.21	-11.57	36.	41.
Z AXIS	1.12	42.58	0.00	123.	0.
RESULTANT	12.33	54.38	4.77	103.	403.
HEADREST FORCES (LB)					
UPPER X AXIS	0.66	7.45	-18.28	44.	7.
LOWER X AXIS	-0.89	11.23	-10.53	11.	30.
X AXIS SUM	-0.23	11.33	-20.24	11.	30.

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DP1 STUDY TEST: 1790 SUBJ: ADAM-L WT: 218.0 NOM G: 8.0 CELL: C1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
LAP FORCES (LB)					
LEFT X AXIS	-26.73	0.00	-25.27	79.	0.
LEFT Y AXIS	10.08	10.40	-2.45	0.	95.
LEFT Z AXIS	-34.94	13.79	-33.35	92.	0.
LEFT RESULTANT	45.14	43.12	3.91	0.	21.
RIGHT X AXIS	-22.92	2.35	-22.92	20.	0.
RIGHT Y AXIS	-0.16	10.70	-2.33	31.	44.
RIGHT Z AXIS	-32.14	16.64	-32.02	100.	0.
RIGHT RESULTANT	39.48	39.38	1.95	0.	41.
SEAT FORCES (LB)					
LEFT X AXIS	-16.14	57.05	-91.52	95.	38.
RIGHT X AXIS	6.07	84.01	-76.27	101.	45.
X AXIS SUM	-10.07	57.23	-149.96	88.	45.
Y AXIS	-4.63	133.90	-52.59	31.	96.
LEFT Z AXIS	-0.18	256.21	-3.06	121.	97.
RIGHT Z AXIS	1.02	336.04	-0.06	114.	0.
CENTER Z AXIS	57.05	1986.33	62.10	117.	0.
Z AXIS SUM	57.89	2516.15	62.10	117.	0.
RESULTANT	59.00	2517.18	62.39	117.	1.
Z SUM MINUS TARE	77.47	2408.38	61.84	117.	3.
RESULTANT MINUS TARE	78.14	2408.39	62.19	117.	3.
ADAM NECK FORCE (LB)					
X AXIS	0.00	3.10	-27.87	13.	128.
Y AXIS	1.04	7.62	-5.30	36.	30.
Z AXIS	-11.57	147.46	-14.46	120.	70.
RESULTANT	11.62	148.18	0.45	121.	323.
ADAM NECK MY (IN-LB)	-0.30	78.59	-15.72	135.	14.
ADAM LUMBAR FORCE (LB)					
X AXIS	-7.46	190.87	-15.39	122.	26.
Y AXIS	-1.98	47.45	-11.86	97.	74.
Z AXIS	-57.37	963.77	-57.37	117.	0.
RESULTANT	57.92	973.26	1.74	118.	11.
ADAM LUMBAR MY (IN-LB)	44.05	124.15	-431.19	26.	124.

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DP1 STUDY TEST: 1791 SUBJ: ADAM-L WT: 218.0 NOM G: 7.0 CELL: D1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
REFERENCE MARK TIME (MS)				-88.	
2.5V EXT PWR (VOLTS)	2.50	2.50	2.50	2.	0.
10V EXT PWR (VOLTS)	10.00	10.00	10.00	0.	1.
CARRIAGE ACCELERATION (G)					
X AXIS	-0.01	2.50	-15.95	14.	21.
Y AXIS	-0.02	5.61	-11.72	20.	23.
Z AXIS	0.00	7.32	-2.37	97.	23.
Z AXIS PEAK 1		7.08		5.	
Z AXIS PEAK 2		7.32		97.	
CARRIAGE VELOCITY (FPS)	25.00	25.47	1.22	0.	439.
SEAT ACCELERATION (G)					
X AXIS	-0.01	3.71	-1.62	19.	42.
Y AXIS	0.04	3.89	-2.69	31.	45.
Z AXIS	-0.06	11.22	-5.37	7.	24.
Z AXIS DRI	-0.10	9.55	-0.64	137.	206.
HEAD ACCELERATION (G)					
X AXIS	-0.22	0.37	-2.51	32.	158.
Y AXIS	0.07	0.77	-0.37	122.	82.
Z AXIS	-0.12	13.60	-0.11	120.	0.
RESULTANT	0.26	13.69	0.14	121.	5.
RY (RAD/SEC2)	-1.63	215.52	-194.37	120.	163.
CHEST ACCELERATION (G)					
X AXIS	-0.41	3.36	-1.89	37.	19.
Y AXIS	0.16	0.75	-0.30	103.	25.
Z AXIS	0.05	14.30	-0.54	121.	15.
RESULTANT	0.45	14.59	0.28	121.	4.
RY (RAD/SEC2)	-0.14	1242.02	-1002.59	48.	127.
SHOULDER STRAP FORCES (LB)					
X AXIS	-12.42	-3.41	-39.20	4.	31.
Y AXIS	0.04	10.59	-8.05	106.	60.
Z AXIS	1.05	40.12	-0.02	106.	405.
RESULTANT	12.47	53.28	3.63	101.	367.
HEADREST FORCES (LB)					
UPPER X AXIS	0.85	6.74	-17.16	44.	7.
LOWER X AXIS	-1.09	10.58	6.20	10.	29.
X AXIS SUM	-0.24	11.17	-16.52	35.	7.

DP1 STUDY TEST: 1791 SUBJ: ADAM-L WT: 218.0 NOM G: 7.0 CELL: D1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
LAP FORCES (LB)					
LEFT X AXIS	-22.74	2.53	-22.74	84.	0.
LEFT Y AXIS	4.88	6.59	-3.93	31.	42.
LEFT Z AXIS	-29.63	12.22	-29.03	17.	0.
LEFT RESULTANT	37.69	37.12	2.43	0.	145.
RIGHT X AXIS	-21.28	1.62	-21.83	20.	0.
RIGHT Y AXIS	-5.92	4.50	-6.79	31.	0.
RIGHT Z AXIS	-28.10	12.65	-28.16	90.	0.
RIGHT RESULTANT	35.75	36.28	1.59	0.	22.
SEAT FORCES (LB)					
LEFT X AXIS	-6.31	43.98	-83.20	99.	44.
RIGHT X AXIS	1.32	41.74	-68.16	130.	45.
X AXIS SUM	-4.99	49.44	-150.18	86.	45.
Y AXIS	0.99	115.90	-34.54	117.	28.
LEFT Z AXIS	0.00	337.49	0.12	117.	0.
RIGHT Z AXIS	-0.78	230.23	-0.06	114.	0.
CENTER Z AXIS	49.74	1924.23	49.98	118.	0.
Z AXIS SUM	48.96	2479.50	50.04	118.	0.
RESULTANT	49.25	2482.24	50.14	118.	1.
Z SUM MINUS TARE	68.75	2353.16	50.23	118.	2.
RESULTANT MINUS TARE	68.94	2353.21	50.30	118.	2.
ADAM NECK FORCE (LB)					
X AXIS	-0.74	5.45	-28.61	387.	140.
Y AXIS	1.42	11.17	-4.97	121.	86.
Z AXIS	-11.74	147.40	-11.62	120.	0.
RESULTANT	11.85	148.97	0.76	120.	329.
ADAM NECK MY (IN-LB)	5.34	76.07	-10.37	134.	13.
ADAM LUMBAR FORCE (LB)					
X AXIS	8.25	198.65	8.25	120.	0.
Y AXIS	-6.96	16.76	-18.82	99.	107.
Z AXIS	-85.38	917.91	-84.66	114.	0.
RESULTANT	86.06	926.80	14.99	114.	371.
ADAM LUMBAR MY (IN-LB)	22.82	117.41	-398.26	26.	122.

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DP1 STUDY TEST: 1792 SUBJ: ADAM-L WT: 218.0 NOM G: 7.0 CELL: E1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
REFERENCE MARK TIME (MS)				-88.	
2.5V EXT PWR (VOLTS)	2.50	2.50	2.50	3.	0.
10V EXT PWR (VOLTS)	10.00	10.00	10.00	1.	0.
CARRIAGE ACCELERATION (G)					
X AXIS	0.04	6.50	-4.74	17.	22.
Y AXIS	0.00	2.18	-4.40	20.	28.
Z AXIS	-0.01	7.90	0.14	94.	0.
Z AXIS PEAK 1		5.19		19.	
Z AXIS PEAK 2		7.90		94.	
CARRIAGE VELOCITY (FPS)	25.01	25.35	1.26	0.	371.
SEAT ACCELERATION (G)					
X AXIS	0.04	5.02	-2.31	26.	21.
Y AXIS	-0.02	3.39	-3.90	30.	12.
Z AXIS	-0.03	8.97	-2.64	120.	36.
Z AXIS DRI	-0.08	9.78	-0.67	131.	200.
HEAD ACCELERATION (G)					
X AXIS	0.03	0.27	-2.44	11.	154.
Y AXIS	0.10	0.66	-0.40	93.	155.
Z AXIS	-0.08	11.91	-0.03	112.	0.
RESULTANT	0.15	11.92	0.18	114.	1.
RY (RAD/SEC2)	-0.78	108.55	-195.56	111.	159.
CHEST ACCELERATION (G)					
X AXIS	-0.23	3.11	-1.63	38.	20.
Y AXIS	0.16	0.81	-0.66	100.	125.
Z AXIS	0.00	11.74	-0.58	115.	16.
RESULTANT	0.29	12.10	0.18	115.	5.
RY (RAD/SEC2)	0.94	789.43	-617.19	129.	122.
SHOULDER STRAP FORCES (LB)					
X AXIS	-13.63	-3.09	-52.16	363.	199.
Y AXIS	0.31	12.84	-10.94	78.	72.
Z AXIS	1.54	41.36	0.00	114.	365.
RESULTANT	13.73	58.09	3.38	199.	363.
HEADREST FORCES (LB)					
UPPER X AXIS	1.00	7.34	-13.49	35.	87.
LOWER X AXIS	-0.93	13.68	-4.97	79.	30.
X AXIS SUM	0.07	12.97	-14.79	63.	31.

DP1 STUDY TEST: 1792 SUBJ: ADAM-L WT: 218.0 NOM G: 7.0 CELL: E1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
LAP FORCES (LB)					
LEFT X AXIS	-21.28	2.53	-22.74	69.	1.
LEFT Y AXIS	4.65	6.94	-4.74	183.	68.
LEFT Z AXIS	-26.95	12.33	-26.95	82.	0.
LEFT RESULTANT	34.67	34.27	0.55	1.	61.
RIGHT X AXIS	-20.44	3.57	-21.69	80.	1.
RIGHT Y AXIS	-5.37	2.71	-5.97	21.	0.
RIGHT Z AXIS	-26.53	14.22	-26.59	94.	0.
RIGHT RESULTANT	33.93	33.74	0.98	0.	49.
SEAT FORCES (LB)					
LEFT X AXIS	-0.07	23.80	-77.24	13.	45.
RIGHT X AXIS	-2.56	15.84	-59.71	31.	53.
X AXIS SUM	-2.63	16.52	-125.28	19.	54.
Y AXIS	1.15	99.56	-69.52	105.	14.
LEFT Z AXIS	-3.30	306.31	-2.94	103.	1.
RIGHT Z AXIS	0.00	230.29	0.00	112.	0.
CENTER Z AXIS	46.61	1768.04	49.98	109.	0.
Z AXIS SUM	43.32	2270.37	47.04	109.	1.
RESULTANT	43.49	2272.19	47.12	109.	1.
Z SUM MINUS TARE	62.72	2139.45	54.18	109.	2.
RESULTANT MINUS TARE	62.79	2139.77	54.21	109.	2.
ADAM NECK FORCE (LB)					
X AXIS	0.18	6.25	-30.91	342.	155.
Y AXIS	1.64	9.66	-4.88	92.	153.
Z AXIS	-11.99	126.35	-12.43	111.	1.
RESULTANT	12.12	126.99	0.87	111.	317.
ADAM NECK MY (IN-LB)	-1.81	70.73	-15.72	142.	14.
ADAM LUMBAR FORCE (LB)					
X AXIS	-0.30	158.67	-15.86	116.	30.
Y AXIS	0.53	23.65	-19.85	50.	89.
Z AXIS	-71.38	826.93	-73.52	109.	2.
RESULTANT	71.41	839.40	0.74	112.	360.
ADAM LUMBAR MY (IN-LB)	64.07	178.49	-297.51	32.	117.

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DP1 STUDY TEST: 1793 SUBJ: ADAM-L WT: 218.0 NOM G: 7.0 CELL: E1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
REFERENCE MARK TIME (MS)				-87.	
2.5V EXT PWR (VOLTS)	2.50	2.50	2.50	1.	0.
10V EXT PWR (VOLTS)	10.00	10.00	10.00	2.	0.
CARRIAGE ACCELERATION (G)					
X AXIS	0.06	5.15	-3.23	20.	25.
Y AXIS	0.01	1.43	-11.97	25.	15.
Z AXIS	-0.01	7.94	0.17	99.	0.
Z AXIS PEAK 1		5.11		17.	
Z AXIS PEAK 2		7.94		99.	
CARRIAGE VELOCITY (FPS)	24.95	25.23	1.26	0.	399.
SEAT ACCELERATION (G)					
X AXIS	0.05	2.44	-1.39	32.	51.
Y AXIS	-0.05	4.93	-6.91	33.	23.
Z AXIS	-0.03	9.06	-2.26	114.	24.
Z AXIS DRI	-0.08	9.91	-0.70	130.	199.
HEAD ACCELERATION (G)					
X AXIS	-0.01	0.24	-2.13	11.	154.
Y AXIS	0.12	0.78	-0.40	69.	32.
Z AXIS	-0.05	12.00	-0.02	111.	0.
RESULTANT	0.15	12.03	0.14	111.	1.
RY (RAD/SEC2)	-1.14	145.58	-132.09	110.	130.
CHEST ACCELERATION (G)					
X AXIS	-0.23	3.17	-1.00	112.	9.
Y AXIS	0.11	0.89	-0.66	36.	53.
Z AXIS	0.05	12.56	-0.51	112.	14.
RESULTANT	0.27	12.96	0.26	112.	4.
RY (RAD/SEC2)	1.51	564.82	-572.45	16.	114.
SHOULDER STRAP FORCES (LB)					
X AXIS	-16.12	-5.11	-41.92	55.	31.
Y AXIS	-0.60	14.31	-18.47	53.	46.
Z AXIS	2.74	41.48	1.34	96.	296.
RESULTANT	16.38	52.79	7.64	105.	314.
HEADREST FORCES (LB)					
UPPER X AXIS	0.96	11.07	-10.99	46.	50.
LOWER X AXIS	-1.83	12.40	9.36	79.	29.
X AXIS SUM	-0.88	15.38	-17.29	46.	29.

DP1 STUDY TEST: 1793 SUBJ: ADAM-L WT: 218.0 NOM G: 7.0 CELL: E1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
LAP FORCES (LB)					
LEFT X AXIS	-22.06	2.53	-25.27	78.	0.
LEFT Y AXIS	2.34	5.84	-15.19	6.	25.
LEFT Z AXIS	-27.65	14.73	-28.48	85.	0.
LEFT RESULTANT	35.47	38.15	2.71	0.	57.
RIGHT X AXIS	-21.90	3.57	-23.49	33.	1.
RIGHT Y AXIS	-5.09	3.59	-13.77	34.	25.
RIGHT Z AXIS	-28.14	12.56	-28.26	77.	0.
RIGHT RESULTANT	36.02	35.98	1.85	0.	64.
SEAT FORCES (LB)					
LEFT X AXIS	3.66	29.71	-66.56	89.	39.
RIGHT X AXIS	-3.52	46.94	-77.85	18.	51.
X AXIS SUM	0.13	24.44	-123.10	17.	52.
Y AXIS	3.28	116.84	-47.27	17.	26.
LEFT Z AXIS	-4.92	256.27	-6.12	114.	0.
RIGHT Z AXIS	2.99	298.76	3.11	123.	0.
CENTER Z AXIS	49.61	1842.89	49.85	115.	0.
Z AXIS SUM	47.68	2360.57	46.84	115.	0.
RESULTANT	47.84	2361.26	47.03	115.	0.
Z SUM MINUS TARE	67.05	2221.81	53.78	116.	3.
RESULTANT MINUS TARE	67.06	2221.82	53.86	116.	3.
ADAM NECK FORCE (LB)					
X AXIS	0.12	9.29	-27.87	361.	121.
Y AXIS	1.53	10.72	-5.42	70.	31.
Z AXIS	-11.56	130.11	-11.56	111.	0.
RESULTANT	11.70	131.49	0.58	111.	14.
ADAM NECK MY (IN-LB)	-4.98	78.74	-23.42	131.	17.
ADAM LUMBAR FORCE (LB)					
X AXIS	-0.47	142.33	-8.41	110.	30.
Y AXIS	0.00	11.86	-15.82	30.	50.
Z AXIS	-74.45	853.85	-74.45	107.	0.
RESULTANT	74.46	861.02	0.51	107.	114.
ADAM LUMBAR MY (IN-LB)	65.54	167.00	-249.50	30.	113.

DP1 STUDY TEST: 1794 SUBJ: ADAM-L WT: 218.0 NOM G: 7.0 CELL: E1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
REFERENCE MARK TIME (MS)				-79.	
2.5V EXT PWR (VOLTS)	2.50	2.50	2.50	94.	13.
10V EXT PWR (VOLTS)	10.00	10.00	10.00	0.	1.
CARRIAGE ACCELERATION (G)					
X AXIS	-0.02	3.67	-19.66	6.	17.
Y AXIS	-0.01	11.18	-11.91	15.	27.
Z AXIS	0.02	7.42	-1.12	99.	17.
Z AXIS PEAK 1		5.98		6.	
Z AXIS PEAK 2		7.42		99.	
CARRIAGE VELOCITY (FPS)	24.48	25.11	1.26	0.	402.
SEAT ACCELERATION (G)					
X AXIS	-0.06	3.94	-2.16	12.	25.
Y AXIS	-0.04	2.36	-2.75	22.	45.
Z AXIS	-0.10	10.19	-2.81	7.	46.
Z AXIS DRI	-0.14	9.37	-0.57	135.	205.
HEAD ACCELERATION (G)					
X AXIS	0.17	0.41	-1.69	11.	156.
Y AXIS	0.11	0.42	-0.39	84.	148.
Z AXIS	-0.14	12.59	-0.09	118.	0.
RESULTANT	0.25	12.64	0.26	120.	0.
RY (RAD/SEC2)	0.45	137.25	-133.81	117.	135.
CHEST ACCELERATION (G)					
X AXIS	-0.13	3.18	-0.99	117.	9.
Y AXIS	0.15	0.77	-0.71	35.	113.
Z AXIS	-0.02	12.32	-1.09	113.	15.
RESULTANT	0.21	12.57	0.22	114.	0.
RY (RAD/SEC2)	1.64	731.00	-698.07	16.	10.
SHOULDER STRAP FORCES (LB)					
X AXIS	-18.31	-8.40	-43.17	47.	9.
Y AXIS	-0.85	9.01	-8.99	23.	30.
Z AXIS	3.75	42.68	3.75	102.	0.
RESULTANT	18.72	57.77	10.67	100.	114.
HEADREST FORCES (LB)					
UPPER X AXIS	0.70	11.73	-15.85	44.	7.
LOWER X AXIS	-0.62	8.70	-13.05	130.	31.
X AXIS SUM	0.08	17.34	-20.88	55.	52.

DP1 STUDY TEST: 1794 SUBJ: ADAM-L WT: 218.0 NOM G: 7.0 CELL: E1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
LAP FORCES (LB)					
LEFT X AXIS	-24.62	0.56	-24.71	82.	0.
LEFT Y AXIS	5.85	5.98	-3.37	1.	34.
LEFT Z AXIS	-31.35	13.83	-31.35	102.	0.
LEFT RESULTANT	40.29	40.21	4.50	0.	141.
RIGHT X AXIS	-19.71	1.80	-21.65	40.	0.
RIGHT Y AXIS	-4.68	3.37	-5.31	21.	0.
RIGHT Z AXIS	-25.68	12.71	-24.96	98.	0.
RIGHT RESULTANT	32.73	33.47	2.38	0.	22.
SEAT FORCES (LB)					
LEFT X AXIS	-2.34	21.66	-72.24	18.	54.
RIGHT X AXIS	0.42	43.53	-75.54	23.	50.
X AXIS SUM	-1.93	40.57	-137.43	86.	47.
Y AXIS	4.62	96.48	-17.90	24.	167.
LEFT Z AXIS	-3.61	330.99	-3.25	117.	0.
RIGHT Z AXIS	-3.19	229.86	-3.55	124.	0.
CENTER Z AXIS	43.48	1811.52	49.73	120.	0.
Z AXIS SUM	36.68	2341.21	42.93	119.	0.
RESULTANT	37.08	2342.78	42.94	119.	0.
Z SUM MINUS TARE	57.23	2219.94	46.78	120.	4.
RESULTANT MINUS TARE	57.27	2219.99	47.75	120.	4.
ADAM NECK FORCE (LB)					
X AXIS	2.80	6.26	-21.61	11.	119.
Y AXIS	1.73	6.33	-3.36	70.	43.
Z AXIS	-11.62	132.95	-11.62	109.	0.
RESULTANT	12.15	134.73	0.15	119.	365.
ADAM NECK MY (IN-LB)	-7.55	71.04	-23.27	134.	16.
ADAM LUMBAR FORCE (LB)					
X AXIS	-7.33	134.86	-7.94	117.	0.
Y AXIS	-0.48	23.25	-8.38	121.	65.
Z AXIS	-45.57	945.57	-47.71	111.	0.
RESULTANT	46.22	951.18	3.71	113.	11.
ADAM LUMBAR MY (IN-LB)	23.89	105.51	-251.49	36.	117.

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DP1 STUDY TEST: 1795 SUBJ: ADAM-L WT: 218.0 NOM G: 7.0 CELL: E1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
REFERENCE MARK TIME (MS)				-69.	
2.5V EXT PWR (VOLTS)	2.50	2.50	2.50	456.	10.
10V EXT PWR (VOLTS)	10.00	10.00	10.00	0.	1.
CARRIAGE ACCELERATION (G)					
X AXIS	0.00	4.03	-13.01	18.	26.
Y AXIS	-0.01	2.18	-16.24	30.	24.
Z AXIS	0.02	7.02	0.10	96.	0.
Z AXIS PEAK 1		5.75		6.	
Z AXIS PEAK 2		7.02		96.	
CARRIAGE VELOCITY (FPS)	24.19	24.82	1.26	0.	388.
SEAT ACCELERATION (G)					
X AXIS	-0.01	3.54	-2.23	18.	24.
Y AXIS	-0.01	4.54	-3.45	31.	40.
Z AXIS	-0.08	9.42	-4.71	7.	25.
Z AXIS DRI	-0.10	9.07	-0.51	138.	207.
HEAD ACCELERATION (G)					
X AXIS	0.19	0.45	-2.06	10.	159.
Y AXIS	0.19	0.54	-0.05	114.	54.
Z AXIS	-0.08	12.47	-0.03	122.	0.
RESULTANT	0.29	12.51	0.35	122.	0.
RY (RAD/SEC2)	1.52	168.32	-168.85	122.	165.
CHEST ACCELERATION (G)					
X AXIS	-0.09	3.01	-0.82	125.	17.
Y AXIS	0.26	1.00	-0.09	124.	70.
Z AXIS	0.03	12.48	-0.42	123.	15.
RESULTANT	0.28	12.79	0.33	123.	16.
RY (RAD/SEC2)	3.43	725.01	-565.64	134.	10.
SHOULDER STRAP FORCES (LB)					
X AXIS	-14.10	-6.11	-40.88	4.	32.
Y AXIS	1.04	11.38	-7.26	80.	45.
Z AXIS	2.16	41.46	1.31	105.	0.
RESULTANT	14.31	56.28	6.63	108.	348.
HEADREST FORCES (LB)					
UPPER X AXIS	0.56	6.90	-15.16	37.	7.
LOWER X AXIS	-0.99	11.18	5.61	96.	21.
X AXIS SUM	-0.43	16.83	-17.09	37.	30.

DP1 STUDY TEST: 1795 SUBJ: ADAM-L WT: 218.0 NOM G: 7.0 CELL: E1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
LAP FORCES (LB)					
LEFT X AXIS	-26.39	0.05	-27.75	84.	1.
LEFT Y AXIS	7.35	8.16	-2.36	2.	21.
LEFT Z AXIS	-33.19	11.98	-33.19	94.	0.
LEFT RESULTANT	43.05	42.35	4.02	1.	75.
RIGHT X AXIS	-25.12	0.14	-25.12	21.	0.
RIGHT Y AXIS	-6.28	5.10	-6.18	32.	0.
RIGHT Z AXIS	-34.29	9.42	-32.97	86.	0.
RIGHT RESULTANT	42.97	41.90	1.92	0.	76.
SEAT FORCES (LB)					
LEFT X AXIS	-7.64	29.53	-70.32	105.	49.
RIGHT X AXIS	-6.59	28.55	-64.18	22.	45.
X AXIS SUM	-14.23	23.91	-123.93	21.	54.
Y AXIS	0.32	95.91	-13.50	118.	20.
LEFT Z AXIS	-1.09	249.77	-3.25	111.	1.
RIGHT Z AXIS	1.00	260.98	-0.44	125.	1.
CENTER Z AXIS	59.10	1830.27	62.22	119.	0.
Z AXIS SUM	59.01	2319.22	58.54	119.	1.
RESULTANT	60.72	2321.21	60.25	118.	1.
Z SUM MINUS TARE	79.20	2197.00	57.48	119.	3.
RESULTANT MINUS TARE	80.47	2197.02	57.86	119.	3.
ADAM NECK FORCE (LB)					
X AXIS	3.04	6.38	-27.68	10.	148.
Y AXIS	1.80	6.46	-1.62	40.	178.
Z AXIS	-10.29	134.27	-10.29	121.	0.
RESULTANT	10.93	135.62	1.29	122.	309.
ADAM NECK MY (IN-LB)	-7.86	70.72	-23.58	134.	17.
ADAM LUMBAR FORCE (LB)					
X AXIS	-12.63	151.52	-15.08	122.	0.
Y AXIS	2.38	14.55	-5.22	49.	67.
Z AXIS	-45.37	909.00	-47.16	115.	1.
RESULTANT	47.34	915.86	1.67	117.	186.
ADAM LUMBAR MY (IN-LB)	32.77	118.20	-318.13	38.	124.

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DP1 STUDY TEST: 1796 SUBJ: ADAM-L WT: 218.0 NOM G: 7.0 CELL: F1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
REFERENCE MARK TIME (MS)				-72.	
2.5V EXT PWR (VOLTS)	2.50	2.50	2.50	24.	21.
10V EXT PWR (VOLTS)	10.00	10.00	10.00	1.	0.
CARRIAGE ACCELERATION (G)					
X AXIS	-0.01	7.17	-22.40	23.	17.
Y AXIS	0.02	24.04	-4.54	17.	26.
Z AXIS	0.00	6.84	0.10	95.	25.
Z AXIS PEAK 1		6.36		6.	
Z AXIS PEAK 2		6.84		95.	
CARRIAGE VELOCITY (FPS)	24.22	24.82	1.26	4.	380.
SEAT ACCELERATION (G)					
X AXIS	-0.02	5.28	-3.86	24.	16.
Y AXIS	0.01	3.55	-3.65	52.	45.
Z AXIS	-0.05	10.79	-3.85	8.	25.
Z AXIS DRI	-0.10	8.86	-0.44	138.	207.
HEAD ACCELERATION (G)					
X AXIS	0.12	0.34	-1.80	80.	129.
Y AXIS	0.07	0.81	-0.40	113.	187.
Z AXIS	-0.10	12.79	-0.07	123.	0.
RESULTANT	0.18	12.84	0.15	123.	0.
RY (RAD/SEC2)	0.64	112.52	-198.20	88.	59.
CHEST ACCELERATION (G)					
X AXIS	-0.19	3.40	-1.35	125.	18.
Y AXIS	0.20	0.99	-0.47	51.	142.
Z AXIS	0.03	12.51	-0.73	123.	15.
RESULTANT	0.28	12.87	0.22	123.	1.
RY (RAD/SEC2)	1.68	552.33	-719.62	47.	10.
SHOULDER STRAP FORCES (LB)					
X AXIS	-16.81	-6.07	-43.90	47.	107.
Y AXIS	0.57	8.97	-9.02	25.	42.
Z AXIS	2.48	45.06	2.48	110.	0.
RESULTANT	17.00	62.05	9.49	108.	310.
HEADREST FORCES (LB)					
UPPER X AXIS	0.98	9.79	-14.72	27.	7.
LOWER X AXIS	-0.83	9.09	-8.94	11.	30.
X AXIS SUM	0.14	12.04	-14.96	27.	8.

DP1 STUDY TEST: 1796 SUBJ: ADAM-L WT: 218.0 NOM G: 7.0 CELL: F1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
LAP FORCES (LB)					
LEFT X AXIS	-24.98	0.00	-25.27	90.	1.
LEFT Y AXIS	7.06	8.18	-3.51	0.	44.
LEFT Z AXIS	-30.51	13.08	-30.13	95.	0.
LEFT RESULTANT	40.06	38.71	3.26	1.	142.
RIGHT X AXIS	-24.77	1.95	-25.12	97.	1.
RIGHT Y AXIS	-4.63	4.72	-5.70	31.	45.
RIGHT Z AXIS	-31.28	12.56	-29.83	18.	0.
RIGHT RESULTANT	40.17	39.19	1.36	1.	23.
SEAT FORCES (LB)					
LEFT X AXIS	-8.53	60.64	-79.61	102.	54.
RIGHT X AXIS	3.33	35.75	-78.88	140.	47.
X AXIS SUM	-5.20	57.02	-149.11	84.	45.
Y AXIS	1.15	98.84	-10.57	119.	14.
LEFT Z AXIS	-4.04	240.21	-6.56	109.	2.
RIGHT Z AXIS	0.24	286.31	0.00	117.	0.
CENTER Z AXIS	49.85	1824.14	49.85	120.	0.
Z AXIS SUM	46.05	2328.83	46.42	120.	0.
RESULTANT	46.37	2330.87	47.06	120.	0.
Z SUM MINUS TARE	65.69	2203.55	49.99	120.	4.
RESULTANT MINUS TARE	65.90	2203.56	51.00	120.	3.
ADAM NECK FORCE (LB)					
X AXIS	0.99	4.09	-29.98	10.	128.
Y AXIS	1.55	9.69	-3.23	110.	156.
Z AXIS	-10.31	138.15	-12.20	121.	71.
RESULTANT	10.48	139.84	1.18	122.	199.
ADAM NECK MY (IN-LB)	-6.29	88.01	-22.01	140.	185.
ADAM LUMBAR FORCE (LB)					
X AXIS	-7.33	119.00	-7.94	123.	0.
Y AXIS	3.19	31.63	-3.96	102.	66.
Z AXIS	-56.24	918.84	-55.89	116.	0.
RESULTANT	56.87	923.00	0.19	116	338.
ADAM LUMBAR MY (IN-LB)	103.10	191.59	-165.41	37.	125.

DPI STUDY TEST: 1797 SUBJ: ADAM-L WT: 218.0 NOM G: 10.0 CELL: G1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
REFERENCE MARK TIME (MS)				-73.	
2.5V EXT PWR (VOLTS)	2.50	2.50	2.50	11.	14.
10V EXT PWR (VOLTS)	10.00	10.00	10.00	3.	0.
CARRIAGE ACCELERATION (G)					
X AXIS	0.00	1.89	-8.99	80.	23.
Y AXIS	0.01	5.06	-2.53	23.	31.
Z AXIS	0.01	7.08	-0.86	92.	24.
Z AXIS PEAK 1		6.72		18.	
Z AXIS PEAK 2		7.08		92.	
CARRIAGE VELOCITY (FPS)	24.29	24.86	1.26	5.	395.
SEAT ACCELERATION (G)					
X AXIS	-0.01	4.54	-1.97	22.	75.
Y AXIS	-0.04	2.59	-3.56	30.	39.
Z AXIS	-0.07	9.66	-4.73	7.	25.
Z AXIS DRI	-0.13	8.93	-0.41	134.	204.
HEAD ACCELERATION (G)					
X AXIS	0.21	0.27	-1.83	10.	156.
Y AXIS	0.18	0.84	-0.44	107.	100.
Z AXIS	-0.13	11.72	-0.12	118.	0.
RESULTANT	0.31	11.75	0.25	120.	5.
RY (RAD/SEC2)	10.54	98.77	-132.62	119.	161.
CHEST ACCELERATION (G)					
X AXIS	-0.20	2.68	-1.12	120.	18.
Y AXIS	0.27	1.36	-0.53	112.	68.
Z AXIS	0.03	11.53	-0.53	118.	15.
RESULTANT	0.34	11.78	0.24	118.	4.
RY (RAD/SEC2)	-3.15	613.83	-624.45	131.	10.
SHOULDER STRAP FORCES (LB)					
X AXIS	-17.74	-8.18	-47.03	57.	32.
Y AXIS	1.37	12.23	-3.84	78.	44.
Z AXIS	3.67	42.55	4.84	105.	0.
RESULTANT	18.17	57.58	11.10	107.	308.
HEADREST FORCES (LB)					
UPPER X AXIS	0.81	9.20	-15.31	35.	7.
LOWER X AXIS	-1.12	11.29	-8.60	12.	31.
X AXIS SUM	-0.31	14.33	-17.78	46.	31.

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DP1 STUDY TEST: 1797 SUBJ: ADAM-L WT: 218.0 NOM G: 10.0 CELL: G1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
LAP FORCES (LB)					
LEFT X AXIS	-25.27	0.00	-25.27	73.	0.
LEFT Y AXIS	2.88	4.67	-4.67	4.	40.
LEFT Z AXIS	-29.85	13.36	-29.85	115.	0.
LEFT RESULTANT	39.23	39.27	5.20	0.	61.
RIGHT X AXIS	-22.48	2.02	-23.24	80.	0.
RIGHT Y AXIS	-6.44	2.60	-6.08	32.	0.
RIGHT Z AXIS	-28.20	12.56	-28.26	92.	0.
RIGHT RESULTANT	36.64	37.09	2.83	0.	31.
SEAT FORCES (LB)					
LEFT X AXIS	0.24	47.38	-47.71	97.	44.
RIGHT X AXIS	-0.17	71.78	-63.31	123.	53.
X AXIS SUM	0.08	54.97	-108.64	123.	53.
Y AXIS	5.50	88.22	-31.13	32.	165.
LEFT Z AXIS	-3.26	365.10	-3.50	123.	0.
RIGHT Z AXIS	-2.24	195.50	-3.67	110.	0.
CENTER Z AXIS	43.35	1748.67	43.11	116.	0.
Z AXIS SUM	37.85	2287.41	35.93	116.	0.
RESULTANT	38.35	2288.51	36.73	116.	0.
Z SUM MINUS TARE	57.98	2176.44	46.73	117.	4.
RESULTANT MINUS TARE	58.00	2176.73	48.60	117.	4.
ADAM NECK FORCE (LB)					
X AXIS	1.13	3.16	-21.62	309.	138.
Y AXIS	3.10	9.69	-1.62	108.	30.
Z AXIS	-11.33	124.67	-11.22	115.	0.
RESULTANT	11.90	126.21	0.35	120.	200.
ADAM NECK MY (IN-LB)	-7.22	63.81	-14.78	133.	15.
ADAM LUMBAR FORCE (LB)					
X AXIS	4.96	116.94	-2.06	116.	3.
Y AXIS	-1.42	26.25	-29.10	97.	125.
Z AXIS	-56.07	872.23	-56.07	114.	0.
RESULTANT	56.37	879.12	6.05	115.	12.
ADAM LUMBAR MY (IN-LB)	1.00	95.59	-241.58	38.	122.

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DP1 STUDY TEST: 1798 SUBJ: ADAM-L WT: 218.0 NOM G: 7.0 CELL: H1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
REFERENCE MARK TIME (MS)				-73.	
2.5V EXT PWR (VOLTS)	2.50	2.50	2.50	1.	14.
10V EXT PWR (VOLTS)	10.00	10.00	10.00	1.	0.
CARRIAGE ACCELERATION (G)					
X AXIS	0.01	4.11	-18.25	23.	19.
Y AXIS	0.00	34.69	-5.85	19.	15.
Z AXIS	0.03	7.13	-4.30	99.	21.
Z AXIS PEAK 1		6.35		5.	
Z AXIS PEAK 2		7.13		99.	
CARRIAGE VELOCITY (FPS)	24.32	24.95	1.22	3.	422.
SEAT ACCELERATION (G)					
X AXIS	0.01	5.40	-2.92	21.	16.
Y AXIS	-0.04	2.46	-3.32	30.	38.
Z AXIS	-0.06	10.41	-3.76	6.	24.
Z AXIS DRI	-0.08	8.68	-0.37	133.	203.
HEAD ACCELERATION (G)					
X AXIS	0.29	0.54	-1.39	11.	124.
Y AXIS	0.09	0.65	-0.45	120.	179.
Z AXIS	-0.07	11.82	-0.11	118.	0.
RESULTANT	0.32	11.87	0.39	118.	2.
RY (RAD/SEC2)	4.75	97.05	-160.78	79.	62.
CHEST ACCELERATION (G)					
X AXIS	-0.03	3.06	-0.96	122.	8.
Y AXIS	0.17	0.82	-0.41	117.	107.
Z AXIS	0.03	11.03	-0.45	117.	14.
RESULTANT	0.18	11.42	0.17	118.	2.
RY (RAD/SEC2)	-0.05	662.83	-777.46	14.	9.
SHOULDER STRAP FORCES (LB)					
X AXIS	-19.47	-8.18	-56.23	269.	31.
Y AXIS	0.45	12.59	-7.34	78.	72.
Z AXIS	4.84	46.20	4.84	97.	0.
RESULTANT	20.07	62.33	13.69	31.	269.
HEADREST FORCES (LB)					
UPPER X AXIS	1.15	7.35	-15.32	35.	80.
LOWER X AXIS	-0.80	14.41	7.35	77.	31.
X AXIS SUM	0.36	13.06	-17.76	35.	31.

DP1 STUDY TEST: 1798 SUBJ: ADAM-L WT: 218.0 NOM G: 7.0 CELL: H1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
LAP FORCES (LB)					
LEFT X AXIS	-25.13	2.48	-25.32	78.	0.
LEFT Y AXIS	7.01	8.18	-2.34	3.	22.
LEFT Z AXIS	-32.18	11.86	-31.35	80.	0.
LEFT RESULTANT	41.43	40.90	2.35	0.	70.
RIGHT X AXIS	-21.70	5.23	-21.83	78.	0.
RIGHT Y AXIS	-6.43	3.49	-6.06	31.	0.
RIGHT Z AXIS	-29.07	12.53	-28.29	91.	0.
RIGHT RESULTANT	36.85	36.24	1.85	0.	33.
SEAT FORCES (LB)					
LEFT X AXIS	-6.03	43.03	-68.70	96.	48.
RIGHT X AXIS	0.35	30.91	-59.53	130.	43.
X AXIS SUM	-5.67	35.02	-115.55	79.	51.
Y AXIS	0.52	108.12	-14.97	114.	14.
LEFT Z AXIS	-3.43	255.96	-0.19	113.	0.
RIGHT Z AXIS	-1.26	253.57	-1.62	112.	0.
CENTER Z AXIS	49.00	1717.56	49.48	115.	0.
Z AXIS SUM	44.31	2227.09	47.67	115.	0.
RESULTANT	44.69	2229.72	48.17	115.	0.
Z SUM MINUS TARE	64.19	2113.46	53.40	116.	2.
RESULTANT MINUS TARE	64.45	2113.48	53.42	116.	2.
ADAM NECK FORCE (LB)					
X AXIS	3.27	6.13	-21.74	0.	119.
Y AXIS	1.75	8.27	-4.65	117.	168.
Z AXIS	-10.08	126.70	-9.19	116.	0.
RESULTANT	10.79	128.33	2.38	117.	321.
ADAM NECK MY (IN-LB)	-7.71	86.60	-23.42	129.	17.
ADAM LUMBAR FORCE (LB)					
X AXIS	-4.61	94.56	-8.57	117.	1.
Y AXIS	0.00	31.63	-7.91	96.	127.
Z AXIS	-38.06	871.68	-38.06	114.	0.
RESULTANT	38.54	876.12	1.13	115.	9.
ADAM LUMBAR MY (IN-LB)	-21.05	117.02	-220.15	36.	122.

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DP1 STUDY TEST: 1799 SUBJ: ADAM-L WT: 218.0 NOM G: 7.0 CELL: I1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
REFERENCE MARK TIME (MS)				-76.	
2.5V EXT PWR (VOLTS)	2.50	2.50	2.50	0.	29.
10V EXT PWR (VOLTS)	10.00	10.00	10.00	0.	14.
CARRIAGE ACCELERATION (G)					
X AXIS	0.01	8.12	-12.99	24.	14.
Y AXIS	0.00	3.58	-11.64	30.	10.
Z AXIS	-0.01	7.32	-0.38	98.	18.
Z AXIS PEAK 1		6.71		15.	
Z AXIS PEAK 2		7.32		98.	
CARRIAGE VELOCITY (FPS)	24.26	24.74	1.22	2.	401.
SEAT ACCELERATION (G)					
X AXIS	-0.02	4.53	-4.59	18.	25.
Y AXIS	-0.01	1.84	-3.26	8.	22.
Z AXIS	-0.06	9.20	-3.28	18.	25.
Z AXIS DRI	-0.12	8.72	-0.35	130.	200.
HEAD ACCELERATION (G)					
X AXIS	0.15	0.30	-1.32	9.	121.
Y AXIS	0.09	0.39	-0.17	71.	92.
Z AXIS	-0.13	11.40	0.03	116.	0.
RESULTANT	0.22	11.45	0.17	116.	0.
RY (RAD/SEC2)	2.90	128.25	-182.47	171.	130.
CHEST ACCELERATION (G)					
X AXIS	-0.18	2.86	-0.75	117.	192.
Y AXIS	0.14	0.82	-0.37	119.	74.
Z AXIS	-0.01	10.89	-0.34	110.	14.
RESULTANT	0.23	11.08	0.18	112.	1.
RY (RAD/SEC2)	-1.51	501.37	-561.08	15.	10.
SHOULDER STRAP FORCES (LB)					
X AXIS	-14.67	-7.16	-41.92	4.	31.
Y AXIS	0.83	10.43	-6.93	65.	46.
Z AXIS	2.60	44.01	2.65	96.	0.
RESULTANT	14.93	58.20	10.93	99.	309.
HEADREST FORCES (LB)					
UPPER X AXIS	0.89	6.24	-13.98	35.	7.
LOWER X AXIS	-0.69	8.78	-7.38	11.	31.
X AXIS SUM	0.20	9.42	-13.29	35.	7.

DP1 STUDY TEST: 1799 SUBJ: ADAM-L WT: 218.0 NOM G: 7.0 CELL: I1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
LAP FORCES (LB)					
LEFT X AXIS	-24.78	3.79	-24.01	77.	0.
LEFT Y AXIS	5.60	6.64	-3.88	3.	26.
LEFT Z AXIS	-28.40	11.86	-27.42	79.	0.
LEFT RESULTANT	38.12	36.85	3.38	0.	34.
RIGHT X AXIS	-23.50	2.45	-22.81	76.	0.
RIGHT Y AXIS	-4.09	2.62	-5.19	76.	178.
RIGHT Z AXIS	-27.91	12.90	-27.91	94.	0.
RIGHT RESULTANT	36.73	36.30	3.00	0.	35.
SEAT FORCES (LB)					
LEFT X AXIS	-0.59	21.39	-52.30	99.	41.
RIGHT X AXIS	3.05	38.05	-46.66	22.	55.
X AXIS SUM	2.45	43.25	-82.76	19.	52.
Y AXIS	0.48	85.79	-9.95	111.	29.
LEFT Z AXIS	-4.09	284.14	-6.37	110.	1.
RIGHT Z AXIS	-2.99	267.64	-3.11	117.	0.
CENTER Z AXIS	42.77	1668.08	43.73	113.	0.
Z AXIS SUM	35.69	2191.80	37.37	113.	0.
RESULTANT	35.83	2193.37	37.64	113.	0.
Z SUM MINUS TARE	55.63	2080.57	43.00	114.	2.
RESULTANT MINUS TARE	55.70	2080.62	43.62	114.	2.
ADAM NECK FORCE (LB)					
X AXIS	1.61	3.16	-21.62	0.	118.
Y AXIS	0.22	4.94	-3.13	71.	153.
Z AXIS	-11.79	121.44	-11.56	109.	0.
RESULTANT	12.01	122.89	0.11	112.	14.
ADAM NECK MY (IN-LB)	-6.93	71.36	-30.80	127.	173.
ADAM LUMBAR FORCE (LB)					
X AXIS	-0.30	63.47	-7.93	116.	29.
Y AXIS	-0.20	18.50	-9.17	119.	106.
Z AXIS	-57.34	853.11	-56.63	110.	1.
RESULTANT	57.39	854.49	1.57	110.	187.
ADAM LUMBAR MY (IN-LB)	14.24	132.48	-105.52	38.	119.

DP1 STUDY TEST: 1800 SUBJ: ADAM-L WT: 218.0 NOM G: 7.0 CELL: J1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
REFERENCE MARK TIME (MS)				-78.	
2.5V EXT PWR (VOLTS)	2.50	2.50	2.50	0.	40.
10V EXT PWR (VOLTS)	10.00	10.00	10.00	0.	2.
CARRIAGE ACCELERATION (G)					
X AXIS	-0.01	5.66	-6.71	20.	24.
Y AXIS	-0.01	4.40	-4.20	23.	16.
Z AXIS	0.02	7.12	0.14	93.	0.
Z AXIS PEAK 1		6.82		19.	
Z AXIS PEAK 2		7.12		93.	
CARRIAGE VELOCITY (FPS)	24.31	24.78	1.26	1.	380.
SEAT ACCELERATION (G)					
X AXIS	-0.03	2.38	-1.31	10.	34.
Y AXIS	-0.05	3.57	-2.81	28.	13.
Z AXIS	-0.08	10.02	-4.19	7.	36.
Z AXIS DRI	-0.12	8.51	-0.28	129.	199.
HEAD ACCELERATION (G)					
X AXIS	0.11	0.24	-1.25	9.	152.
Y AXIS	0.10	0.77	-0.44	131.	179.
Z AXIS	-0.11	11.05	-0.04	115.	0.
RESULTANT	0.19	11.09	0.18	115.	0.
RY (RAD/SEC2)	4.19	112.25	-185.24	48.	61.
CHEST ACCELERATION (G)					
X AXIS	-0.20	2.54	-1.10	120.	18.
Y AXIS	0.17	0.85	-0.37	52.	79.
Z AXIS	-0.01	10.24	-0.23	117.	15.
RESULTANT	0.27	10.54	0.25	118.	5.
RY (RAD/SEC2)	1.36	532.87	-544.54	128.	10.
SHOULDER STRAP FORCES (LB)					
X AXIS	-14.30	-5.34	-42.14	5.	31.
Y AXIS	0.78	14.77	-9.65	38.	32.
Z AXIS	2.06	41.51	2.58	94.	0.
RESULTANT	14.49	53.17	9.31	98.	334.
HEADREST FORCES (LB)					
UPPER X AXIS	1.40	11.23	-15.12	36.	40.
LOWER X AXIS	1.35	12.52	-13.59	73.	39.
X AXIS SUM	2.75	18.77	-25.65	36.	39.

DP1 STUDY TEST: 1800 SUBJ: ADAM-L WT: 218.0 NOM G: 7.0 CELL: J1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
LAP FORCES (LB)					
LEFT X AXIS	-25.40	1.72	-26.08	24.	0.
LEFT Y AXIS	4.91	5.49	-3.86	1.	22.
LEFT Z AXIS	-28.60	12.57	-28.68	78.	0.
LEFT RESULTANT	38.58	39.00	3.52	0.	141.
RIGHT X AXIS	-23.67	4.44	-22.63	21.	0.
RIGHT Y AXIS	-6.44	4.41	-6.88	30.	13.
RIGHT Z AXIS	-28.85	12.75	-28.07	89.	0.
RIGHT RESULTANT	37.88	36.55	2.90	0.	54.
SEAT FORCES (LB)					
LEFT X AXIS	-3.11	28.38	-44.12	21.	56.
RIGHT X AXIS	2.66	39.95	-48.20	23.	52.
X AXIS SUM	-0.46	53.37	-81.80	30.	50.
Y AXIS	0.57	121.84	-49.73	119.	19.
LEFT Z AXIS	-3.26	326.06	-5.06	119.	0.
RIGHT Z AXIS	-3.49	223.70	-3.49	112.	0.
CENTER Z AXIS	43.98	1599.61	43.98	113.	0.
Z AXIS SUM	37.24	2130.62	35.44	113.	0.
RESULTANT	37.35	2134.14	35.86	113.	0.
Z SUM MINUS TARE	57.42	2011.01	38.67	113.	3.
RESULTANT MINUS TARE	57.47	2011.21	40.05	113.	3.
ADAM NECK FORCE (LB)					
X AXIS	1.79	3.10	-24.77	0.	123.
Y AXIS	0.74	10.37	-5.78	129.	173.
Z AXIS	-12.11	116.00	-11.22	112.	0.
RESULTANT	12.36	117.70	0.76	116.	14.
ADAM NECK MY (IN-LB)	-6.40	65.54	-20.90	124.	170.
ADAM LUMBAR FORCE (LB)					
X AXIS	-1.52	63.47	-15.86	119.	37.
Y AXIS	1.65	36.93	-6.56	48.	120.
Z AXIS	-65.35	807.26	-65.35	111.	0.
RESULTANT	65.47	808.77	1.39	113.	173.
ADAM LUMBAR MY (IN-LB)	79.34	198.34	-59.49	38.	120.

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DP1 STUDY TEST: 1801 SUBJ: ADAM-L WT: 218.0 NOM G: 7.0 CELL: K1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
REFERENCE MARK TIME (MS)				-82.	
2.5V EXT PWR (VOLTS)	2.50	2.50	2.50	67.	0.
10V EXT PWR (VOLTS)	10.00	10.00	10.00	0.	19.
CARRIAGE ACCELERATION (G)					
X AXIS	-0.04	3.87	-11.60	30.	22.
Y AXIS	-0.01	11.99	-1.29	16.	29.
Z AXIS	0.02	7.14	0.40	94.	0.
Z AXIS PEAK 1		6.77		5.	
Z AXIS PEAK 2		7.14		94.	
CARRIAGE VELOCITY (FPS)	24.38	24.70	1.26	0.	369.
SEAT ACCELERATION (G)					
X AXIS	-0.06	5.34	-1.94	29.	34.
Y AXIS	-0.01	1.56	-3.24	7.	36.
Z AXIS	-0.10	10.30	-4.16	7.	35.
Z AXIS DRI	-0.10	8.33	-0.25	128.	198.
HEAD ACCELERATION (G)					
X AXIS	0.18	0.37	-1.39	36.	122.
Y AXIS	0.09	0.38	-0.39	112.	270.
Z AXIS	-0.02	11.51	-0.15	116.	0.
RESULTANT	0.22	11.54	0.21	116.	3.
RY (RAD/SEC2)	-0.63	158.80	-224.64	47.	59.
CHEST ACCELERATION (G)					
X AXIS	-0.14	2.92	-0.97	120.	17.
Y AXIS	0.16	0.95	-0.69	119.	102.
Z AXIS	0.00	10.65	-0.42	116.	14.
RESULTANT	0.24	10.86	0.21	116.	4.
RY (RAD/SEC2)	-2.45	467.63	-478.85	127.	9.
SHOULDER STRAP FORCES (LB)					
X AXIS	-13.53	-5.28	-39.02	264.	9.
Y AXIS	1.21	10.93	-7.71	24.	30.
Z AXIS	1.98	39.93	3.43	92.	0.
RESULTANT	13.74	52.38	11.12	102.	305.
HEADREST FORCES (LB)					
UPPER X AXIS	1.11	5.51	-16.54	36.	7.
LOWER X AXIS	-1.11	12.78	-2.76	11.	50.
X AXIS SUM	0.00	12.11	-14.39	35.	39.

DP1 STUDY TEST: 1801 SUBJ: ADAM-L WT: 218.0 NOM G: 7.0 CELL: K1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
LAP FORCES (LB)					
LEFT X AXIS	-24.06	2.48	-25.32	30.	0.
LEFT Y AXIS	7.40	7.08	-2.27	0.	35.
LEFT Z AXIS	-29.74	11.43	-29.82	18.	0.
LEFT RESULTANT	38.98	39.75	1.29	0.	22.
RIGHT X AXIS	-22.52	1.77	-23.49	18.	1.
RIGHT Y AXIS	-3.54	3.40	-3.54	28.	0.
RIGHT Z AXIS	-27.60	13.94	-28.44	18.	0.
RIGHT RESULTANT	35.80	35.95	1.60	0.	22.
SEAT FORCES (LB)					
LEFT X AXIS	-0.20	41.17	-31.33	115.	48.
RIGHT X AXIS	1.32	38.97	-58.34	22.	115.
X AXIS SUM	1.12	48.49	-58.76	30.	48.
Y AXIS	-1.82	89.52	-9.95	109.	15.
LEFT Z AXIS	-4.33	256.15	-6.25	108.	0.
RIGHT Z AXIS	-2.55	313.32	-4.11	116.	0.
CENTER Z AXIS	49.38	1611.73	43.61	111.	0.
Z AXIS SUM	42.50	2122.01	33.25	111.	0.
RESULTANT	42.69	2123.32	33.69	111.	0.
Z SUM MINUS TARE	63.17	2016.97	45.58	111.	2.
RESULTANT MINUS TARE	63.25	2017.02	45.78	111.	2.
ADAM NECK FORCE (LB)					
X AXIS	1.31	6.19	-24.77	9.	122.
Y AXIS	0.81	5.65	-5.65	111.	160.
Z AXIS	-11.75	119.47	-13.53	114.	0.
RESULTANT	11.94	121.04	1.23	114.	15.
ADAM NECK MY (IN-LB)	-7.25	70.73	-23.57	126.	175.
ADAM LUMBAR FORCE (LB)					
X AXIS	-1.24	70.77	-0.63	115.	0.
Y AXIS	1.58	25.31	-14.24	45.	96.
Z AXIS	-55.38	829.72	-61.45	112.	0.
RESULTANT	55.45	831.64	6.00	112.	187.
ADAM LUMBAR MY (IN-LB)	35.27	163.42	-134.08	36.	121.

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DP1 STUDY TEST: 1802 SUBJ: ADAM-L WT: 218.0 NOM G: 7.0 CELL: L1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
REFERENCE MARK TIME (MS)				-82.	
2.5V EXT PWR (VOLTS)	2.50	2.50	2.50	411.	19.
10V EXT PWR (VOLTS)	10.00	10.00	10.00	0.	4.
CARRIAGE ACCELERATION (G)					
X AXIS	-0.04	4.43	-5.60	33.	26.
Y AXIS	0.01	4.32	-11.88	19.	24.
Z AXIS	0.01	7.28	0.36	83.	0.
Z AXIS PEAK 1		6.07		5.	
Z AXIS PEAK 2		7.28		83.	
CARRIAGE VELOCITY (FPS)	24.46	24.66	1.26	0.	393.
SEAT ACCELERATION (G)					
X AXIS	-0.04	3.67	-2.43	22.	38.
Y AXIS	0.01	4.39	-5.09	19.	29.
Z AXIS	-0.10	9.38	-2.30	19.	25.
Z AXIS DRI	-0.14	8.14	-0.15	125.	195.
HEAD ACCELERATION (G)					
X AXIS	0.17	0.39	-1.20	12.	119.
Y AXIS	0.09	0.55	-0.36	79.	126.
Z AXIS	-0.09	9.90	-0.08	111.	0.
RESULTANT	0.22	9.92	0.23	113.	3.
RY (RAD/SEC2)	3.90	117.81	-146.63	49.	63.
CHEST ACCELERATION (G)					
X AXIS	-0.16	2.36	-0.88	49.	9.
Y AXIS	0.15	0.98	-0.52	36.	23.
Z AXIS	-0.01	9.27	-0.29	112.	14.
RESULTANT	0.22	9.45	0.20	113.	0.
RY (RAD/SEC2)	-1.36	535.04	-527.41	14.	9.
SHOULDER STRAP FORCES (LB)					
X AXIS	-15.98	-5.48	-43.31	55.	32.
Y AXIS	0.32	14.14	-19.28	37.	31.
Z AXIS	3.70	41.46	3.75	96.	0.
RESULTANT	16.41	52.42	11.44	95.	93.
HEADREST FORCES (LB)					
UPPER X AXIS	1.22	7.77	-14.29	44.	7.
LOWER X AXIS	-0.58	11.85	9.29	45.	29.
X AXIS SUM	0.63	19.01	-16.77	55.	41.

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DP1 STUDY TEST: 1802 SUBJ: ADAM-L WT: 218.0 NOM G: 7.0 CELL: L1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
LAP FORCES (LB)					
LEFT X AXIS	-23.38	2.48	-25.32	32.	1.
LEFT Y AXIS	7.84	8.16	-5.87	0.	34.
LEFT Z AXIS	-31.07	12.14	-29.11	80.	0.
LEFT RESULTANT	39.68	39.43	2.32	1.	53.
RIGHT X AXIS	-20.18	6.60	-20.46	33.	0.
RIGHT Y AXIS	-2.25	5.76	-5.52	19.	33.
RIGHT Z AXIS	-26.11	12.78	-24.90	19.	0.
RIGHT RESULTANT	33.09	32.29	1.35	0.	24.
SEAT FORCES (LB)					
LEFT X AXIS	-1.12	17.85	-65.35	19.	50.
RIGHT X AXIS	-1.47	56.69	-81.83	23.	57.
X AXIS SUM	-2.59	65.39	-118.56	19.	51.
Y AXIS	-3.25	114.43	-2.44	23.	0.
LEFT Z AXIS	1.62	259.21	3.06	104.	0.
RIGHT Z AXIS	-1.58	295.15	-3.61	116.	1.
CENTER Z AXIS	42.52	1467.91	43.48	108.	0.
Z AXIS SUM	42.57	1994.25	42.93	109.	1.
RESULTANT	42.85	1996.65	43.19	109.	1.
Z SUM MINUS TARE	63.14	1872.38	48.61	108.	2.
RESULTANT MINUS TARE	63.20	1873.19	48.73	108.	2.
ADAM NECK FORCE (LB)					
X AXIS	2.50	6.19	-18.58	7.	115.
Y AXIS	0.48	6.75	-4.55	69.	260.
Z AXIS	-11.93	106.06	-12.49	112.	1.
RESULTANT	12.26	107.18	0.97	112.	421.
ADAM NECK MY (IN-LB)	-7.55	62.87	-23.57	123.	5.
ADAM LUMBAR FORCE (LB)					
X AXIS	-0.94	31.10	-32.37	116.	36.
Y AXIS	-0.08	19.69	-11.94	39.	104.
Z AXIS	-43.03	723.89	-46.60	109.	0.
RESULTANT	43.09	724.06	3.93	110.	180.
ADAM LUMBAR MY (IN-LB)	64.83	257.83	-39.67	38.	149.

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DP1 STUDY TEST: 1803 SUBJ: ADAM-L WT: 218.0 NOM G: 7.0 CELL: M1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
REFERENCE MARK TIME (MS)				-85.	
2.5V EXT PWR (VOLTS)	2.50	2.50	2.50	17.	0.
10V EXT PWR (VOLTS)	10.00	10.00	10.00	1.	16.
CARRIAGE ACCELERATION (G)					
X AXIS	-0.02	4.84	-15.99	32.	26.
Y AXIS	0.07	12.46	-25.78	17.	21.
Z AXIS	0.01	7.08	-2.49	19.	26.
Z AXIS PEAK 1		7.08		19.	
Z AXIS PEAK 2		6.96		93.	
CARRIAGE VELOCITY (FPS)	24.49	25.06	1.21	6.	384.
SEAT ACCELERATION (G)					
X AXIS	-0.05	4.09	-1.60	23.	36.
Y AXIS	0.11	3.13	-3.29	29.	38.
Z AXIS	-0.06	11.11	-6.29	7.	25.
Z AXIS DRI	-0.13	7.84	-0.10	127.	0.
HEAD ACCELERATION (G)					
X AXIS	0.09	0.71	-1.86	38.	149.
Y AXIS	0.08	0.51	-0.37	39.	129.
Z AXIS	-0.12	10.79	-0.21	37.	148.
RESULTANT	0.17	10.82	0.17	37.	4.
RY (RAD/SEC2)	-8.12	139.10	-204.68	46.	155.
CHEST ACCELERATION (G)					
X AXIS	-0.22	3.44	-0.77	47.	9.
Y AXIS	0.16	0.80	-0.32	44.	108.
Z AXIS	-0.01	9.97	-0.42	118.	15.
RESULTANT	0.28	10.12	0.14	118.	16.
RY (RAD/SEC2)	-7.40	624.98	-478.62	47.	74.
SHOULDER STRAP FORCES (LB)					
X AXIS	-12.83	-4.97	-39.73	5.	114.
Y AXIS	0.55	9.53	-7.83	24.	43.
Z AXIS	1.81	42.14	0.78	109.	330.
RESULTANT	12.99	54.48	5.16	114.	348.
HEADREST FORCES (LB)					
UPPER X AXIS	0.95	7.01	-16.27	37.	7.
LOWER X AXIS	0.18	14.98	5.53	15.	30.
X AXIS SUM	1.13	12.80	-16.29	15.	40.

DP1 STUDY TEST: 1803 SUBJ: ADAM-L WT: 218.0 NOM G: 7.0 CELL: M1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
LAP FORCES (LB)					
LEFT X AXIS	-25.16	0.30	-24.97	32.	0.
LEFT Y AXIS	3.08	4.11	-5.24	5.	37.
LEFT Z AXIS	-28.40	12.02	-29.23	19.	0.
LEFT RESULTANT	38.07	38.55	1.82	0.	33.
RIGHT X AXIS	-21.63	3.36	-25.52	32.	181.
RIGHT Y AXIS	-5.86	3.56	-6.86	29.	169.
RIGHT Z AXIS	-25.04	13.66	-24.02	19.	0.
RIGHT RESULTANT	33.61	34.51	1.13	181.	23.
SEAT FORCES (LB)					
LEFT X AXIS	-0.80	22.61	-30.88	18.	47.
RIGHT X AXIS	2.57	47.35	-35.08	23.	56.
X AXIS SUM	1.77	49.18	-60.15	20.	50.
Y AXIS	3.80	101.25	-10.64	109.	15.
LEFT Z AXIS	-0.05	337.55	0.19	107.	0.
RIGHT Z AXIS	-4.61	199.24	-6.16	32.	1.
CENTER Z AXIS	40.62	1496.53	40.86	117.	0.
Z AXIS SUM	35.96	2008.37	34.88	117.	1.
RESULTANT	36.32	2009.99	35.59	117.	1.
Z SUM MINUS TARE	55.92	1906.73	40.43	117.	3.
RESULTANT MINUS TARE	55.96	1906.88	40.56	117.	3.
ADAM NECK FORCE (LB)					
X AXIS	2.20	6.13	-18.64	2.	123.
Y AXIS	0.03	6.49	-3.20	39.	31.
Z AXIS	-11.85	112.59	-11.74	37.	0.
RESULTANT	12.13	112.73	0.19	37.	200.
ADAM NECK MY (IN-LB)	-0.76	54.85	-15.87	130.	21.
ADAM LUMBAR FORCE (LB)					
X AXIS	-1.88	93.93	-9.20	118.	10.
Y AXIS	-0.15	19.93	-7.75	40.	60.
Z AXIS	-78.30	758.24	-77.23	38.	0.
RESULTANT	78.36	758.55	3.23	38.	308.
ADAM LUMBAR MY (IN-LB)	31.51	155.09	-142.41	35.	121.

DP1 STUDY TEST: 1804 SUBJ: ADAM-L WT: 218.0 NOM G: 7.0 CELL: N1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
REFERENCE MARK TIME (MS)				-84.	
2.5V EXT PWR (VOLTS)	2.50	2.50	2.50	21.	23.
10V EXT PWR (VOLTS)	10.00	10.00	10.00	21.	23.
CARRIAGE ACCELERATION (G)					
X AXIS	-0.02	1.61	-10.59	193.	20.
Y AXIS	-0.01	4.08	-13.01	28.	23.
Z AXIS	0.03	7.20	0.34	81.	0.
Z AXIS PEAK 1		6.53		11.	
Z AXIS PEAK 2		7.20		81.	
CARRIAGE VELOCITY (FPS)	24.56	25.06	1.25	0.	404.
SEAT ACCELERATION (G)					
X AXIS	-0.06	5.43	-1.96	14.	198.
Y AXIS	0.00	1.73	-1.88	204.	13.
Z AXIS	-0.07	8.39	-0.94	93.	28.
Z AXIS DRI	-0.10	7.82	-0.07	123.	0.
HEAD ACCELERATION (G)					
X AXIS	0.25	0.67	-1.74	37.	148.
Y AXIS	0.07	0.75	-0.36	39.	56.
Z AXIS	-0.06	10.21	-0.14	37.	1.
RESULTANT	0.27	10.24	0.30	37.	5.
RY (RAD/SEC2)	2.12	177.31	-173.08	47.	153.
CHEST ACCELERATION (G)					
X AXIS	-0.09	3.02	-0.81	47.	18.
Y AXIS	0.14	0.79	-0.41	44.	56.
Z AXIS	0.02	9.61	-0.44	114.	15.
RESULTANT	0.17	9.78	0.18	114.	2.
RY (RAD/SEC2)	-0.90	859.39	-592.13	48.	71.
SHOULDER STRAP FORCES (LB)					
X AXIS	-12.23	-4.64	-39.40	342.	110.
Y AXIS	1.55	11.61	-6.39	38.	46.
Z AXIS	1.61	41.24	1.10	105.	336.
RESULTANT	12.47	54.52	5.77	110.	354.
HEADREST FORCES (LB)					
UPPER X AXIS	1.47	10.05	-14.46	27.	8.
LOWER X AXIS	0.54	12.99	-5.04	11.	24.
X AXIS SUM	2.01	18.07	-13.98	27.	41.

DPI STUDY TEST: 1804 SUBJ: ADAM-L WT: 218.0 NOM G: 7.0 CELL: N1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
LAP FORCES (LB)					
LEFT X AXIS	-23.28	2.48	-25.32	15.	0.
LEFT Y AXIS	5.15	5.96	-2.22	0.	23.
LEFT Z AXIS	-29.11	12.22	-29.03	19.	0.
LEFT RESULTANT	37.64	38.98	2.62	0.	48.
RIGHT X AXIS	-23.46	1.80	-27.07	18.	177.
RIGHT Y AXIS	-6.27	0.64	-7.17	18.	170.
RIGHT Z AXIS	-30.13	12.56	-29.83	18.	0.
RIGHT RESULTANT	38.70	39.63	0.64	177.	25.
SEAT FORCES (LB)					
LEFT X AXIS	0.49	45.93	-45.60	15.	43.
RIGHT X AXIS	1.50	36.11	-50.90	17.	46.
X AXIS SUM	1.98	77.46	-93.06	15.	44.
Y AXIS	-0.10	67.14	-21.14	109.	16.
LEFT Z AXIS	-3.37	249.78	-3.25	118.	0.
RIGHT Z AXIS	-4.93	240.69	-5.17	110.	0.
CENTER Z AXIS	52.72	1480.03	55.60	109.	0.
Z AXIS SUM	44.42	1964.25	47.19	110.	0.
RESULTANT	44.56	1965.59	47.22	110.	1.
Z SUM MINUS TARE	64.45	1841.40	20.04	110.	6.
RESULTANT MINUS TARE	64.51	1841.62	25.52	110.	6.
ADAM NECK FORCE (LB)					
X AXIS	3.47	6.69	-18.09	10.	84.
Y AXIS	0.26	8.33	-6.20	41.	159.
Z AXIS	-9.40	104.03	-11.62	37.	2.
RESULTANT	10.05	105.16	0.56	112.	17.
ADAM NECK MY (IN-LB)	-4.10	62.40	-16.19	57.	14.
ADAM LUMBAR FORCE (LB)					
X AXIS	-0.31	94.89	-8.25	114.	7.
Y AXIS	-1.52	21.75	-5.93	89.	252.
Z AXIS	-50.69	714.80	-46.41	39.	0.
RESULTANT	50.73	715.21	2.00	39.	12.
ADAM LUMBAR MY (IN-LB)	-17.33	94.81	-182.86	34.	116.

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DP1 STUDY TEST: 1805 SUBJ: ADAM-L WT: 218.0 NOM G: 7.0 CELL: L1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
REFERENCE MARK TIME (MS)				-80.	
2.5V EXT PWR (VOLTS)	2.50	2.50	2.50	73.	0.
10V EXT PWR (VOLTS)	10.00	10.00	10.00	1.	0.
CARRIAGE ACCELERATION (G)					
X AXIS	-0.01	6.93	-9.35	22.	26.
Y AXIS	0.09	1.35	-8.34	17.	13.
Z AXIS	0.01	7.02	0.16	6.	0.
Z AXIS PEAK 1		7.02		6.	
Z AXIS PEAK 2		7.02		85.	
CARRIAGE VELOCITY (FPS)	24.59	25.23	1.26	2.	390.
SEAT ACCELERATION (G)					
X AXIS	-0.02	3.71	-2.18	26.	22.
Y AXIS	0.12	2.70	-3.06	18.	37.
Z AXIS	-0.05	10.85	-2.88	8.	36.
Z AXIS DRI	-0.10	7.95	-0.09	128.	198.
HEAD ACCELERATION (G)					
X AXIS	0.17	0.64	-1.93	39.	150.
Y AXIS	0.12	0.81	-0.18	82.	24.
Z AXIS	-0.05	10.49	-0.05	114.	0.
RESULTANT	0.22	10.50	0.26	114.	6.
RY (RAD/SEC2)	1.52	191.46	-172.15	48.	156.
CHEST ACCELERATION (G)					
X AXIS	-0.12	3.42	-1.00	48.	19.
Y AXIS	0.21	1.37	-0.20	36.	32.
Z AXIS	0.05	10.25	-0.22	116.	15.
RESULTANT	0.25	10.38	0.21	116.	2.
RY (RAD/SEC2)	-1.65	434.03	-546.11	48.	148.
SHOULDER STRAP FORCES (LB)					
X AXIS	-11.88	-2.21	-40.04	400.	122.
Y AXIS	0.79	14.14	-6.43	77.	31.
Z AXIS	1.41	40.29	0.15	117.	399.
RESULTANT	12.00	53.64	2.90	114.	400.
HEADREST FORCES (LB)					
UPPER X AXIS	1.15	9.19	-16.54	54.	8.
LOWER X AXIS	-0.93	14.92	-9.32	70.	51.
X AXIS SUM	0.22	18.52	20.04	54.	40.

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DP1 STUDY TEST: 1805 SUBJ: ADAM-L WT: 218.0 NOM G: 7.0 CELL: L1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
LAP FORCES (LB)					
LEFT X AXIS	-23.28	2.58	-27.75	33.	175.
LEFT Y AXIS	3.81	5.47	-3.88	176.	38.
LEFT Z AXIS	-28.43	11.98	-29.27	81.	178.
LEFT RESULTANT	36.96	40.56	1.81	178.	34.
RIGHT X AXIS	-20.27	3.61	-19.85	32.	0.
RIGHT Y AXIS	-5.45	3.26	-5.42	31.	0.
RIGHT Z AXIS	-25.31	12.24	-23.86	18.	0.
RIGHT RESULTANT	32.89	31.51	1.12	0.	24.
SEAT FORCES (LB)					
LEFT X AXIS	-5.57	12.12	-58.00	15.	48.
RIGHT X AXIS	-1.54	32.10	-66.35	23.	42.
X AXIS SUM	-7.11	33.92	-115.20	15.	49.
Y AXIS	5.50	67.14	-6.22	32.	169.
LEFT Z AXIS	-3.88	302.13	-7.12	121.	1.
RIGHT Z AXIS	-4.49	213.12	-4.73	113.	2.
CENTER Z AXIS	43.47	1536.39	49.48	114.	0.
Z AXIS SUM	35.10	2032.89	40.74	114.	1.
RESULTANT	36.28	2033.84	42.71	114.	2.
Z SUM MINUS TARE	54.88	1920.53	44.50	115.	3.
RESULTANT MINUS TARE	55.35	1920.66	44.79	115.	3.
ADAM NECK FORCE (LB)					
X AXIS	1.86	3.41	-24.46	0.	150.
Y AXIS	1.94	11.69	-1.23	79.	21.
Z AXIS	-11.16	107.39	-11.16	112.	0.
RESULTANT	11.58	108.28	0.64	112.	330.
ADAM NECK MY (IN-LB)	-2.57	62.71	-15.87	143.	21.
ADAM LUMBAR FORCE (LB)					
X AXIS	-6.06	115.99	-10.95	118.	0.
Y AXIS	-0.99	9.81	-17.87	22.	122.
Z AXIS	-65.18	723.53	-65.53	113.	0.
RESULTANT	65.61	731.62	3.60	114.	12.
ADAM LUMBAR MY (IN-LB)	-0.80	78.53	-218.97	35.	119.

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DP1 STUDY TEST: 1806 SUBJ: ADAM-L WT: 218.0 NOM G: 7.0 CELL: E1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
REFERENCE MARK TIME (MS)				-70.	
2.5V EXT PWR (VOLTS)	2.50	2.50	2.50	167.	0.
10V EXT PWR (VOLTS)	10.00	10.00	10.00	1.	0.
CARRIAGE ACCELERATION (G)					
X AXIS	-0.01	4.67	-4.92	38.	17.
Y AXIS	0.02	4.94	-3.66	19.	8.
Z AXIS	0.02	7.36	0.26	104.	0.
Z AXIS PEAK 1		5.62		5.	
Z AXIS PEAK 2		7.36		104.	
CARRIAGE VELOCITY (FPS)	24.18	24.74	1.22	0.	390.
SEAT ACCELERATION (G)					
X AXIS	-0.02	4.57	-2.85	37.	42.
Y AXIS	0.03	3.19	-3.07	18.	47.
Z AXIS	-0.08	8.94	-2.19	17.	45.
Z AXIS DRI	-0.11	9.22	-0.48	135.	205.
HEAD ACCELERATION (G)					
X AXIS	0.20	0.37	-1.22	11.	159.
Y AXIS	0.00	0.85	-0.29	143.	28.
Z AXIS	-0.05	11.99	-0.13	114.	0.
RESULTANT	0.21	12.01	0.24	114.	1.
RY (RAD/SEC2)	0.00	105.78	-105.78	119.	165.
CHEST ACCELERATION (G)					
X AXIS	-0.11	3.18	-1.37	119.	18.
Y AXIS	0.09	1.23	-0.53	102.	17.
Z AXIS	0.01	11.55	-0.18	119.	14.
RESULTANT	0.15	11.99	0.12	119.	3.
RY (RAD/SEC2)	-1.42	578.44	-521.42	53.	59.
SHOULDER STRAP FORCES (LB)					
X AXIS	-11.27	1.98	-36.87	13.	42.
Y AXIS	0.35	14.14	-7.07	23.	18.
Z AXIS	1.80	42.55	1.19	106.	336.
RESULTANT	11.44	52.14	3.59	108.	400.
HEADREST FORCES (LB)					
UPPER X AXIS	0.92	8.63	-17.11	43.	18.
LOWER X AXIS	-1.19	12.46	-9.92	11.	29.
X AXIS SUM	-0.27	14.34	-15.84	11.	18.

DP1 STUDY TEST: 1806 SUBJ: ADAM-L WT: 218.0 NOM G: 7.0 CELL: E1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
LAP FORCES (LB)					
LEFT X AXIS	-17.98	4.95	-20.32	38.	188.
LEFT Y AXIS	-0.11	3.58	-5.77	18.	45.
LEFT Z AXIS	-26.65	14.30	-26.95	86.	0.
LEFT RESULTANT	32.16	32.31	0.56	0.	21.
RIGHT X AXIS	-15.98	5.74	-15.92	38.	0.
RIGHT Y AXIS	-5.19	4.39	-6.02	19.	47.
RIGHT Z AXIS	-19.03	12.37	-19.03	18.	0.
RIGHT RESULTANT	25.39	25.34	1.42	0.	22.
SEAT FORCES (LB)					
LEFT X AXIS	3.58	82.94	-48.99	99.	43.
RIGHT X AXIS	1.58	111.05	-44.65	120.	60.
X AXIS SUM	5.16	116.73	-79.77	120.	54.
Y AXIS	12.74	90.73	-43.54	21.	61.
LEFT Z AXIS	-5.79	447.63	-5.31	124.	0.
RIGHT Z AXIS	-1.62	150.75	-1.74	100.	0.
CENTER Z AXIS	31.81	1748.43	30.36	111.	0.
Z AXIS SUM	24.39	2278.21	23.31	112.	0.
RESULTANT	28.03	2280.84	26.99	112.	0.
Z SUM MINUS TARE	44.58	2160.91	22.88	112.	3.
RESULTANT MINUS TARE	44.88	2162.54	29.68	112.	3.
ADAM NECK FORCE (LB)					
X AXIS	2.78	7.31	-14.37	8.	124.
Y AXIS	-0.09	11.46	-3.07	76.	27.
Z AXIS	-10.65	132.25	-12.32	113.	0.
RESULTANT	11.12	132.55	1.35	115.	14.
ADAM NECK MY (IN-LB)	-2.42	47.15	-7.86	108.	0.
ADAM LUMBAR FORCE (LB)					
X AXIS	-7.85	121.22	-13.65	117.	0.
Y AXIS	-5.61	12.34	-43.02	98.	118.
Z AXIS	-44.82	965.25	-46.60	112.	0.
RESULTANT	46.04	971.62	4.13	115.	189.
ADAM LUMBAR MY (IN-LB)	49.61	90.04	-247.13	38.	124.

DP1 STUDY TEST: 1807 SUBJ: ADAM-L WT: 218.0 NOM G: 7.0 CELL: E1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
REFERENCE MARK TIME (MS)				-70.	
2.5V EXT PWR (VOLTS)	2.50	2.50	2.50	0.	34.
10V EXT PWR (VOLTS)	10.00	10.00	10.00	1.	0.
CARRIAGE ACCELERATION (G)					
X AXIS	0.02	3.68	-22.88	37.	21.
Y AXIS	0.01	3.33	-12.47	29.	24.
Z AXIS	0.02	7.68	-0.09	17.	25.
Z AXIS PEAK 1		7.68		17.	
Z AXIS PEAK 2		6.59		99.	
CARRIAGE VELOCITY (FPS)	24.14	24.58	1.26	0.	418.
SEAT ACCELERATION (G)					
X AXIS	-0.01	4.75	-3.18	37.	19.
Y AXIS	0.01	3.45	-2.64	8.	46.
Z AXIS	-0.06	11.44	-3.94	7.	26.
Z AXIS DRI	-0.12	8.75	-0.44	141.	211.
HEAD ACCELERATION (G)					
X AXIS	0.00	0.68	-1.69	36.	160.
Y AXIS	-0.05	0.63	-0.26	41.	30.
Z AXIS	-0.11	14.34	-1.33	126.	68.
RESULTANT	0.13	14.35	0.08	126.	0.
RY (RAD/SEC2)	-2.39	212.22	-144.78	125.	138.
CHEST ACCELERATION (G)					
X AXIS	-0.26	3.33	-1.16	128.	76.
Y AXIS	0.07	1.28	-0.32	129.	75.
Z AXIS	0.01	13.92	-1.25	127.	69.
RESULTANT	0.27	14.32	0.13	127.	4.
RY (RAD/SEC2)	0.72	1047.63	-781.72	47.	54.
SHOULDER STRAP FORCES (LB)					
X AXIS	-10.77	7.91	-47.30	38.	32.
Y AXIS	0.86	12.95	-11.48	37.	43.
Z AXIS	1.46	37.91	1.41	111.	0.
RESULTANT	10.91	50.83	3.70	32.	61.
HEADREST FORCES (LB)					
UPPER X AXIS	0.89	12.98	-18.88	37.	7.
LOWER X AXIS	-0.85	14.02	-12.71	15.	30.
X AXIS SUM	0.04	25.76	-23.62	37.	31.

DP1 STUDY TEST: 1807 SUBJ: ADAM-L WT: 218.0 NOM G: 7.0 CELL: E1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
LAP FORCES (LB)					
LEFT X AXIS	-22.55	2.53	-22.74	38.	0.
LEFT Y AXIS	4.46	5.59	-3.76	3.	47.
LEFT Z AXIS	-27.80	11.78	-27.50	17.	0.
LEFT RESULTANT	36.08	35.96	2.69	0.	147.
RIGHT X AXIS	-19.47	1.77	-18.08	21.	0.
RIGHT Y AXIS	-5.19	3.46	-6.09	33.	1.
RIGHT Z AXIS	-25.48	12.62	-25.05	18.	0.
RIGHT RESULTANT	32.49	31.49	0.89	1.	23.
SEAT FORCES (LB)					
LEFT X AXIS	-2.89	66.28	-64.47	105.	56.
RIGHT X AXIS	8.19	91.59	-80.14	110.	44.
X AXIS SUM	5.30	74.92	-122.16	109.	45.
Y AXIS	5.55	67.19	-29.79	130.	75.
LEFT Z AXIS	-4.08	331.37	-6.00	132.	2.
RIGHT Z AXIS	-4.11	316.44	-4.11	121.	0.
CENTER Z AXIS	44.10	1868.13	43.86	124.	0.
Z AXIS SUM	35.92	2478.46	36.88	124.	0.
RESULTANT	36.83	2479.64	38.12	124.	0.
Z SUM MINUS TARE	55.84	2357.54	4.10	125.	5.
RESULTANT MINUS TARE	56.15	2358.07	29.68	125.	4.
ADAM NECK FORCE (LB)					
X AXIS	0.07	3.28	-21.49	8.	149.
Y AXIS	-0.56	9.69	-3.23	115.	356.
Z AXIS	-10.99	153.70	-22.67	125.	68.
RESULTANT	11.08	154.54	0.50	125.	16.
ADAM NECK MY (IN-LB)	-3.14	71.51	-14.93	137.	5.
ADAM LUMBAR FORCE (LB)					
X AXIS	-2.74	126.94	-7.93	124.	0.
Y AXIS	-2.33	24.43	-30.92	106.	134.
Z AXIS	-75.20	1001.27	-84.84	119.	68.
RESULTANT	75.40	1006.78	1.48	122.	344.
ADAM LUMBAR MY (IN-LB)	55.69	158.68	-198.32	35.	126.

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DP1 STUDY TEST: 1808 SUBJ: ADAM-L WT: 218.0 NOM G: 6.0 CELL: B1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
REFERENCE MARK TIME (MS)				-110.	
2.5V EXT PWR (VOLTS)	2.50	2.50	2.50	0.	0.
10V EXT PWR (VOLTS)	10.00	10.00	10.00	0.	2.
CARRIAGE ACCELERATION (G)					
X AXIS	-0.06	1.93	-1.69	17.	22.
Y AXIS	0.01	0.68	-0.37	18.	50.
Z AXIS	0.16	5.93	0.52	101.	0.
CARRIAGE VELOCITY (FPS)	19.03	19.67	1.26	16.	391.
SEAT ACCELERATION (G)					
X AXIS	-0.08	1.51	-1.47	17.	22.
Y AXIS	0.11	1.13	-1.93	31.	21.
Z AXIS	0.06	6.71	-0.03	77.	21.
Z AXIS DRI	-0.06	7.32	0.03	111.	0.
HEAD ACCELERATION (G)					
X AXIS	0.07	0.64	-1.05	81.	116.
Y AXIS	0.02	0.41	-0.18	88.	180.
Z AXIS	-0.06	8.83	0.07	83.	0.
RESULTANT	0.12	8.86	0.10	83.	0.
RY (RAD/SEC2)	0.26	79.34	-85.94	89.	127.
CHEST ACCELERATION (G)					
X AXIS	-0.20	2.38	-0.64	91.	182.
Y AXIS	0.07	0.55	-0.34	82.	113.
Z AXIS	0.06	8.70	0.16	87.	0.
RESULTANT	0.23	8.83	0.29	88.	0.
RY (RAD/SEC2)	-1.76	214.36	-238.30	107.	101.
SHOULDER STRAP FORCES (LB)					
X AXIS	-14.27	-5.11	-27.61	310.	65.
Y AXIS	-0.24	5.42	-5.50	96.	41.
Z AXIS	3.36	30.68	2.70	77.	322.
RESULTANT	14.67	41.34	7.30	78.	310.
HEADREST FORCES (LB)					
UPPER X AXIS	0.92	3.68	-9.80	39.	64.
LOWER X AXIS	-0.61	9.98	-2.45	61.	58.
X AXIS SUM	0.31	10.60	-9.15	61.	64.

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DP1 STUDY TEST: 1808 SUBJ: ADAM-L WT: 218.0 NOM G: 6.0 CELL: B1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
LAP FORCES (LB)					
LEFT X AXIS	-25.20	0.45	-24.82	63.	0.
LEFT Y AXIS	4.58	4.63	-1.22	0.	64.
LEFT Z AXIS	-30.29	8.84	-28.48	66.	0.
LEFT RESULTANT	39.68	38.06	2.29	0.	54.
RIGHT X AXIS	-22.11	1.77	-19.88	63.	0.
RIGHT Y AXIS	-6.56	0.05	-6.03	75.	0.
RIGHT Z AXIS	-26.26	7.85	-21.98	63.	0.
RIGHT RESULTANT	34.96	30.24	1.77	0.	52.
SEAT FORCES (LB)					
LEFT X AXIS	-7.49	20.99	-37.25	78.	316.
RIGHT X AXIS	0.47	27.73	-35.24	18.	78.
X AXIS SUM	-7.02	33.27	-43.83	18.	325.
Y AXIS	6.00	84.42	-5.10	95.	23.
LEFT Z AXIS	4.44	293.63	6.25	87.	0.
RIGHT Z AXIS	-1.68	180.50	3.11	77.	0.
CENTER Z AXIS	46.63	1330.97	56.48	91.	0.
Z AXIS SUM	49.40	1761.49	65.84	91.	0.
RESULTANT	50.28	1763.18	68.19	91.	0.
Z SUM MINUS TARE	67.07	1669.50	79.58	91.	0.
RESULTANT MINUS TARE	67.45	1669.52	80.18	91.	0.
ADAM NECK FORCE (LB)					
X AXIS	2.16	5.14	-16.54	303.	117.
Y AXIS	0.90	6.36	-1.71	89.	4.
Z AXIS	-10.76	96.22	-7.86	87.	0.
RESULTANT	11.05	96.36	1.33	87.	26.
ADAM NECK MY (IN-LB)	1.93	54.22	-8.64	105.	175.
ADAM LUMBAR FORCE (LB)					
X AXIS	-6.72	63.15	-16.18	97.	45.
Y AXIS	-5.24	12.10	-15.58	77.	121.
Z AXIS	-51.77	668.38	-37.13	88.	0.
RESULTANT	52.60	670.09	0.39	91.	23.
ADAM LUMBAR MY (IN-LB)	120.62	190.80	-7.54	39.	97.

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DP1 STUDY TEST: 1809 SUBJ: ADAM-L WT: 218.0 NOM G: 7.0 CELL: B1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
REFERENCE MARK TIME (MS)				-139.	
2.5V EXT PWR (VOLTS)	2.50	2.50	2.50	237.	443.
10V EXT PWR (VOLTS)	10.00	10.00	10.00	0.	3.
CARRIAGE ACCELERATION (G)					
X AXIS	-0.04	1.37	-1.49	62.	57.
Y AXIS	-0.01	0.51	-0.42	15.	57.
Z AXIS	0.10	6.99	0.49	96.	0.
CARRIAGE VELOCITY (FPS)	21.18	21.92	1.26	16.	367.
SEAT ACCELERATION (G)					
X AXIS	-0.05	1.34	-1.35	51.	56.
Y AXIS	0.00	0.81	-1.33	127.	56.
Z AXIS	-0.02	7.89	0.34	72.	0.
Z AXIS DRI	-0.06	8.86	-0.18	107.	181.
HEAD ACCELERATION (G)					
X AXIS	0.16	0.75	-1.45	76.	117.
Y AXIS	0.10	0.48	-0.26	93.	162.
Z AXIS	-0.10	11.44	0.07	86.	0.
RESULTANT	0.22	11.45	0.16	87.	5.
RY (RAD/SEC2)	3.64	183.92	-100.36	87.	101.
CHEST ACCELERATION (G)					
X AXIS	-0.15	2.66	-0.54	83.	178.
Y AXIS	0.21	0.77	-0.25	73.	118.
Z AXIS	0.02	11.30	0.16	87.	0.
RESULTANT	0.26	11.62	0.25	88.	5.
RY (RAD/SEC2)	-1.99	284.92	-227.60	147.	91.
SHOULDER STRAP FORCES (LB)					
X AXIS	-11.72	-4.09	-32.72	294.	65.
Y AXIS	0.25	8.41	-5.09	67.	113.
Z AXIS	1.59	38.17	1.68	76.	297.
RESULTANT	11.86	47.78	4.42	76.	325.
HEADREST FORCES (LB)					
UPPER X AXIS	1.18	3.68	-11.03	149.	63.
LOWER X AXIS	-0.63	10.58	-1.85	60.	161.
X AXIS SUM	0.55	8.13	-9.77	60.	63.

DP1 STUDY TEST: 1809 SUBJ: ADAM-L WT: 218.0 NOM G: 7.0 CELL: B1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
LAP FORCES (LB)					
LEFT X AXIS	-22.74	0.00	-22.74	51.	0.
LEFT Y AXIS	4.36	4.63	-2.38	0.	55.
LEFT Z AXIS	-27.26	10.13	-25.22	63.	0.
LEFT RESULTANT	35.77	34.27	2.54	0.	52.
RIGHT X AXIS	-21.00	3.57	-19.88	52.	0.
RIGHT Y AXIS	-5.23	1.75	-4.32	96.	0.
RIGHT Z AXIS	-25.74	9.64	-23.33	61.	0.
RIGHT RESULTANT	33.64	30.96	1.79	0.	43.
SEAT FORCES (LB)					
LEFT X AXIS	-7.00	20.06	-31.05	71.	316.
RIGHT X AXIS	-0.73	28.51	-19.58	94.	71.
X AXIS SUM	-7.73	29.60	-36.89	98.	318.
Y AXIS	2.35	93.35	-11.09	78.	170.
LEFT Z AXIS	-0.63	313.19	0.81	83.	0.
RIGHT Z AXIS	-3.05	217.78	-0.06	72.	0.
CENTER Z AXIS	43.61	1636.72	56.10	86.	0.
Z AXIS SUM	39.92	2130.35	56.85	87.	0.
RESULTANT	40.77	2132.57	57.55	87.	0.
Z SUM MINUS TARE	59.00	2010.16	69.17	87.	0.
RESULTANT MINUS TARE	59.52	2010.36	69.46	87.	0.
ADAM NECK FORCE (LB)					
X AXIS	2.69	8.05	-22.92	317.	111.
Y AXIS	1.52	7.98	-3.33	94.	154.
Z AXIS	-10.51	132.83	-8.85	86.	0.
RESULTANT	11.05	132.99	1.26	86.	172.
ADAM NECK MY (IN-LB)	-4.82	63.18	-15.40	100.	160.
ADAM LUMBAR FORCE (LB)					
X AXIS	-0.91	111.07	-7.93	86.	27.
Y AXIS	-1.00	13.60	-25.94	70.	83.
Z AXIS	-55.70	854.04	-55.70	80.	0.
RESULTANT	55.80	857.30	1.74	81.	25.
ADAM LUMBAR MY (IN-LB)	41.22	139.62	-177.71	47.	90.

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DP1 STUDY TEST: 1810 SUBJ: ADAM-L WT: 218.0 NOM G: 8.0 CELL: B1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
REFERENCE MARK TIME (MS)				-144.	
2.5V EXT PWR (VOLTS)	2.50	2.50	2.50	0.	0.
10V EXT PWR (VOLTS)	10.00	10.00	10.00	0.	5.
CARRIAGE ACCELERATION (G)					
X AXIS	-0.06	2.54	-1.61	14.	19.
Y AXIS	0.00	0.48	-0.42	17.	54.
Z AXIS	0.08	7.98	0.52	90.	0.
CARRIAGE VELOCITY (FPS)	23.26	23.92	1.22	1.	423.
SEAT ACCELERATION (G)					
X AXIS	-0.07	2.35	-1.44	13.	53.
Y AXIS	0.02	0.95	-0.98	26.	52.
Z AXIS	-0.02	9.32	0.27	76.	0.
Z AXIS DRI	-0.02	10.44	-0.69	102.	174.
HEAD ACCELERATION (G)					
X AXIS	0.09	1.70	-1.45	69.	103.
Y AXIS	0.03	0.84	-0.38	76.	122.
Z AXIS	-0.02	15.17	-0.03	79.	2.
RESULTANT	0.11	15.18	0.12	79.	0.
RY (RAD/SEC2)	-1.56	319.84	-109.88	77.	109.
CHEST ACCELERATION (G)					
X AXIS	-0.14	4.54	-0.61	77.	169.
Y AXIS	0.18	0.80	-0.94	82.	74.
Z AXIS	0.06	14.58	0.16	80.	0.
RESULTANT	0.27	14.93	0.33	80.	0.
RY (RAD/SEC2)	-1.35	711.32	-654.15	69.	75.
SHOULDER STRAP FORCES (LB)					
X AXIS	-11.68	-4.17	-34.84	321.	61.
Y AXIS	0.17	7.69	-3.88	70.	81.
Z AXIS	1.57	43.92	1.34	65.	323.
RESULTANT	11.82	54.78	4.89	69.	321.
HEADREST FORCES (LB)					
UPPER X AXIS	0.97	1.84	-11.03	47.	98.
LOWER X AXIS	-0.73	11.80	-1.88	57.	50.
X AXIS SUM	0.24	11.77	-11.66	47.	108.

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DP1 STUDY TEST: 1810 SUBJ: ADAM-L WT: 218.0 NOM G: 8.0 CELL: B1

DATA ID	IMMEDIATE PREIMPACT	MAXIMUM VALUE	MINIMUM VALUE	TIME OF MAXIMUM	TIME OF MINIMUM
LAP FORCES (LB)					
LEFT X AXIS	-22.59	2.68	-25.12	49.	0.
LEFT Y AXIS	4.63	5.75	-1.26	1.	52.
LEFT Z AXIS	-26.72	12.33	-24.98	60.	0.
LEFT RESULTANT	35.30	35.72	4.12	0.	41.
RIGHT X AXIS	-19.71	1.81	-19.85	48.	0.
RIGHT Y AXIS	-5.28	0.87	-4.34	72.	0.
RIGHT Z AXIS	-25.18	12.56	-25.12	62.	0.
RIGHT RESULTANT	32.41	32.31	1.74	0.	37.
SEAT FORCES (LB)					
LEFT X AXIS	-9.04	27.12	-34.68	37.	300.
RIGHT X AXIS	3.47	26.72	-27.09	32.	134.
X AXIS SUM	-5.57	41.08	-42.80	14.	135.
Y AXIS	7.27	99.46	-9.95	73.	167.
LEFT Z AXIS	1.46	394.09	3.62	84.	0.
RIGHT Z AXIS	5.07	229.73	2.55	84.	0.
CENTER Z AXIS	41.21	2017.82	43.61	76.	0.
Z AXIS SUM	47.73	2616.72	49.78	76.	0.
RESULTANT	48.74	2618.43	51.86	76.	0.
Z SUM MINUS TARE	66.79	2460.80	63.43	76.	0.
RESULTANT MINUS TARE	67.06	2460.82	64.31	76.	0.
ADAM NECK FORCE (LB)					
X AXIS	1.24	7.43	-23.54	69.	100.
Y AXIS	0.24	7.01	-5.91	74.	127.
Z AXIS	-9.12	156.13	-8.67	69.	0.
RESULTANT	9.23	156.62	1.35	78.	176.
ADAM NECK MY (IN-LB)	-1.65	63.03	-15.56	90.	8.
ADAM LUMBAR FORCE (LB)					
X AXIS	0.00	142.80	-23.80	78.	65.
Y AXIS	-1.26	6.80	-20.88	77.	71.
Z AXIS	-55.89	1058.08	-55.89	70.	0.
RESULTANT	55.91	1060.69	1.12	71.	26.
ADAM LUMBAR MY (IN-LB)	47.99	236.40	-239.60	65.	79.

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